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QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

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SUMMARY REPORT LIMESTONE RESOURCES OF QUEENSLAND

Prepared by the Geological Survey of Queensland
under the supervision of T. H. CONNAH, M.Sc.,
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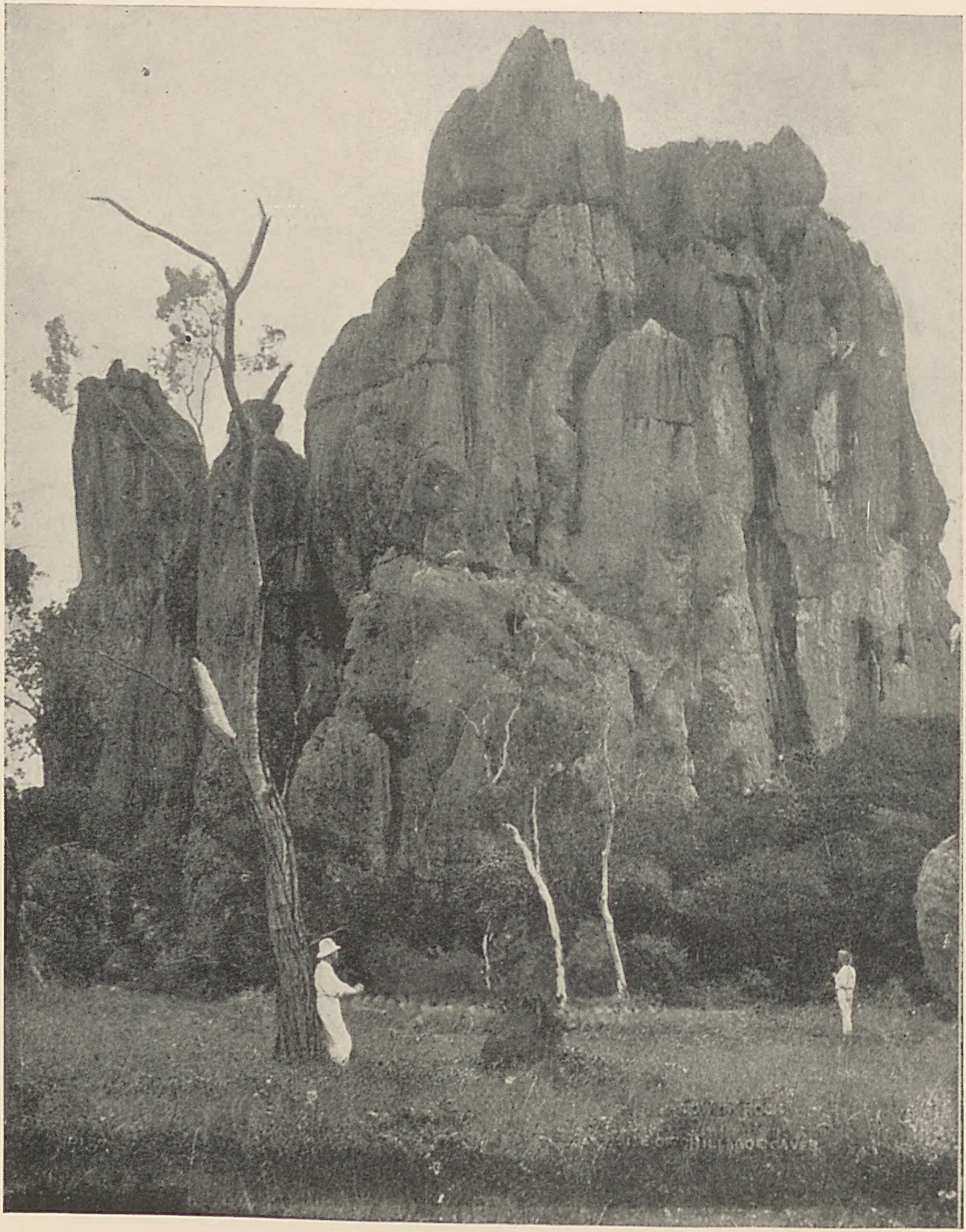

Tower Rock—a typical pinnacle of cavernous limestone, Chillagoe.

FOREWORD

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The following pages set out in summary form what is known of the State's limestone resources. The report was compiled in response to numerous requests for information, reflecting the growing interest in this most important commodity.

It is disclosed that Queensland possesses vast resources of high quality limestone. The great majority of the deposits are distributed along the eastern coast within easy reach of the seaboard (few of the important deposits are more than 50 miles from the coast).

The greatest concentration of limestone is in a 100-mile-long belt about Gladstone and and Rockhampton. It is not without interest that some of our most important coalfields are found in the same belt, the high class semi-anthracites of Bluff and Baralaba being specially significant.

A noteworthy feature of the limestones is that in general the largest deposits contain the purest limestone; it would be possible to quarry many millions of tons assaying 95 per cent. or more calcium carbonate.

Ornamental marbles, some of them of great beauty, are found in association with many of the limestones, notably those at Ulam and in the Northumberland Islands.

The bulk of the current production of limestone is absorbed by the cement works at Brisbane and Townsville. The balance is used as a fertiliser, or as a flux in metallurgical operations.

A. K. DENMEAD,

Chief Government Geologist.

21st November, 1958.

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SUMMARY REPORT

LIMESTONE RESOURCES OF QUEENSLAND

Prepared by the Geological Survey of Queensland, under the supervision of
T. H. Connah, M.Sc., Senior Geologist.

LIMESTONE deposits are widely distributed in the eastern portion of Queensland. Many of these are of large dimensions and of high quality and although little detailed testing has been done there are undoubtedly vast reserves of good stone available for quarrying suitable for all purposes.

Deposits favourably situated as regards transport to the main consuming centres have been exploited to varying extent, but many large deposits still remain virtually untouched because of inaccessibility. Of the main provincial centres, the Rockhampton, Gladstone, Townsville, and Maryborough areas are most favourably endowed. The capital is rather less fortunate, since, apart from large coralline accumulations in Moreton Bay which are dredged for cement-making, no important limestone deposits are known within 100 miles of Brisbane. Many smaller deposits have provided material, both raw and burnt, for local agricultural use, particularly on the cane fields and for smelter flux on the mining fields.

Large quantities of limestone exist also in the belt of ancient rocks in the north-west of the State, where some of the more conveniently situated occurrences have been worked for metallurgical flux.

The limestone deposits of Queensland range in geological age from pre-Cambrian to Recent. The great majority are in the Palaeozoic formations extending from the Silurian to the Permian. Cambrian and pre-Cambrian limestones occur in the north-west and an isolated minor occurrence in lower Triassic rocks occurs near Esk; while still younger deposits include the vast accumulations of coralline material of the Great Barrier Reef, as well as several small occurrences of both Tertiary and post-Tertiary age in the northern half of the State.

The majority of the limestones are of organic origin, such as the coralline limestones of Chillagoe, Reid River, Mount Etna, and Silverwood; the crinoidal limestones of Marmor and Barambah, the algal limestones of Gigoomgan, and the shelly limestones of Yatton and Cracow. Other deposits are non-fossiliferous and some are believed to be of chemical origin, such as that at Dalysford and the superficial earthy deposits at Reid River, Home Hill, and Bajool. Chalk deposits are not known in Queensland.

Deposits of true dolomite-rock are unknown in the State, but the massive "dolomite" at Mount Isa is worthy of note, and magnesian limestone occurs in quantity at Flinders, south of Ipswich.

The summaries which follow are arranged, as far as possible, under districts. The prefixed letters A, B, and C indicate the following classifications:—

A. Major deposits of ready accessibility.

B. Other large deposits of lesser extent and/or less readily accessible.

C. Minor deposits.

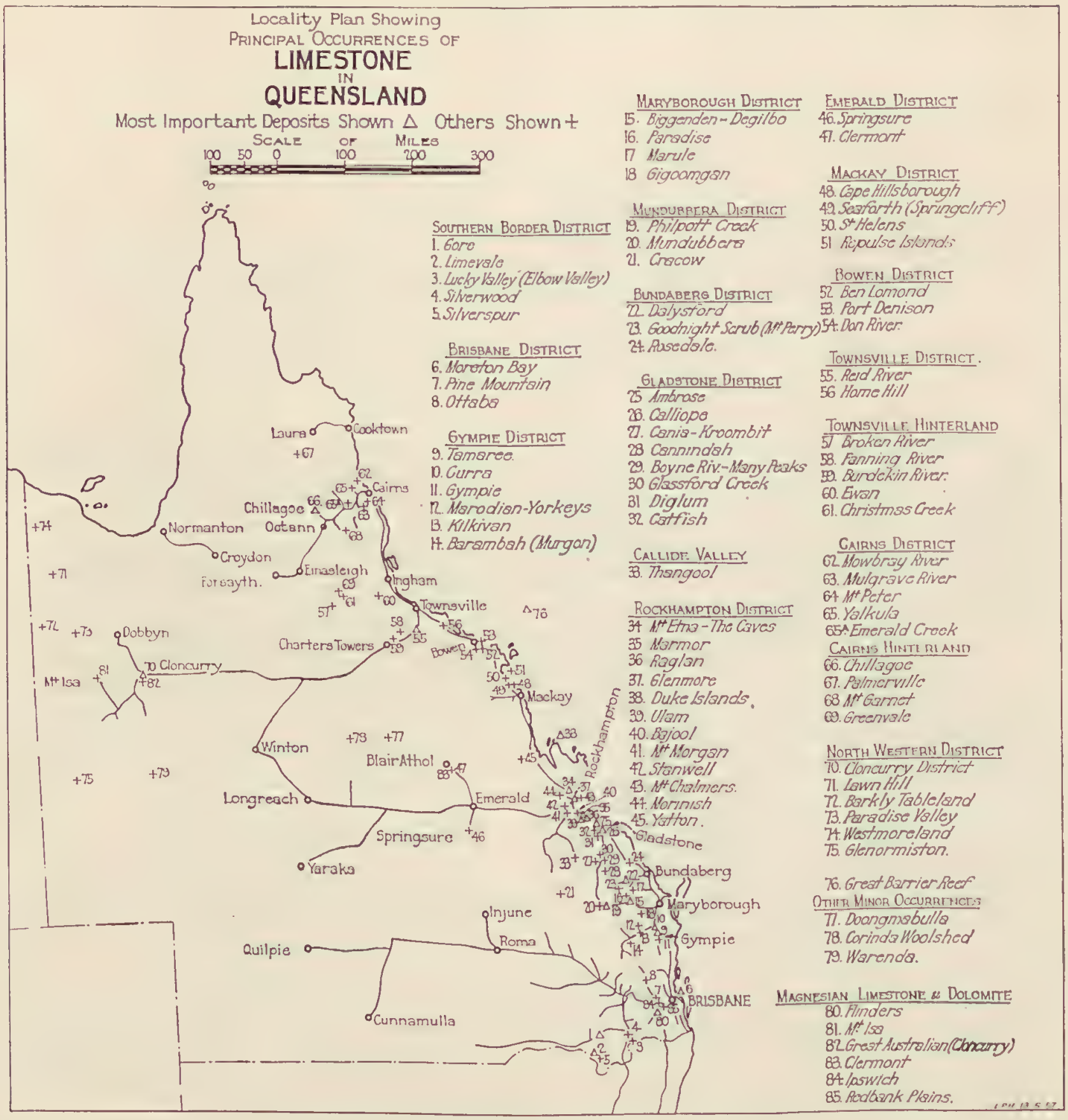
Several occurrences of marble are included. Some of these are already utilized for building and monumental stone, and others may eventually prove of value as sources of such material.

1. Southern Border District.

(A) Gore (45 miles by rail westerly from Warwick).

Large quantities of limestone occur to the SSE. of Gore railway station. The limestones occur as lenticular masses interbedded with slates, striking NW.–SE. and dipping nearly vertically. Outcrops occur over a distance of at least 6 miles from near the railway at Gore to beyond Macintyre Brook. It seems certain that large quantities suitable for quarrying, could be made available.

The principal workings are about 4 miles southerly from Gore railway station. Light-grey limestone has been exposed in a quarry over a width of at least 40 ft. and to a depth of more than 120 ft. The limestone has been proved by boring to continue to at least 200 ft. depth, but the full vertical extent is not known. A feature of the quarry is the presence of cave- and joint-fillings, the presence of which handicaps cheap exploitation to some extent. To the NW. the outcrop is traceable for 300 yd. with a width of 100 ft.



The limestone is of very good quality. A sample gave on analysis—

	Per cent.
Moisture	trace
Loss on Ignition	43.4
SiO_2	0.4
Fe_2O_3	0.1
Al_2O_3	0.1
CaO	55.9
MgO	nil

In an old quarry near the railway stone of somewhat inferior quality was met. The limestone to the SE. of the present quarries, beyond Macintyre Brook is better situated for quarrying purposes, but is further from the railway.

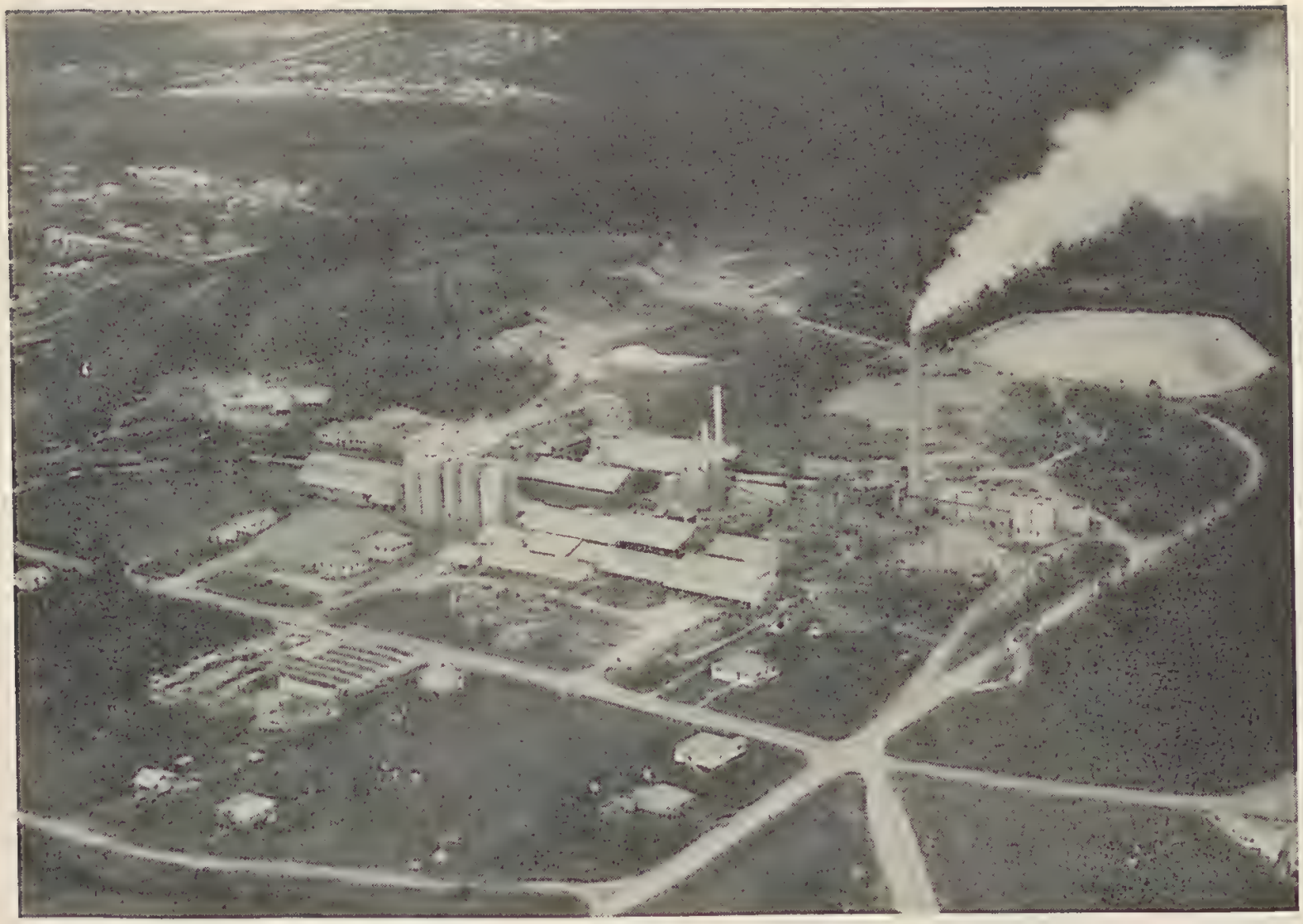
Another bed of similar limestone is reported 10 miles S. by W. of Gore railway station.

Limestone has been quarried here for many years for lime-burning. Supplies were formerly obtained for cement-making in Brisbane, until a more convenient source of supply was obtained.

Age: Probably Lower Devonian.

(A) LIMEVALE (about 10 miles N. of Texas, and 2–3 miles from the railway).

Marble occurs at Limevale, and has been quarried for building purposes in portion 28, parish Silver Spur. In colour the marble ranges from greyish-white through grey and red to almost black with mottled and veined varieties and is stated to be obtainable in blocks of any required size. It is fine-grained and even-textured and takes a fine polish. The full extent of the deposit has not been proved,



Aerial view of Queensland Cement and Lime Company Works at Darra, near Brisbane.
Stockpile of coral in top right-hand corner.

but there are large quantities available. The stone is utilized for monumental and building purposes and, as chips, in terrazzo.

Age: Lower Carboniferous.

(B) Lucky Valley (or Elbow Valley) (7 miles E. by S. of Silverwood railway station).

Limestones outcrop at several places at Lucky Valley, the main occurrences being in R. 49, portions 1200, 1219, 106, and 107, parish Wildash. The locality is 12–15 miles by road SE. of Warwick. A nearby large granite intrusion has produced a white marble which is rather coarse-textured for the most part, and much jointed. In portion 1219 a belt up to 15 chains in width of coarse marble extends NW. towards portion 106, carrying in places small masses of garnet.

On Reserve R. 49, a Brisbane cement-manufacturing company proved reserves of 2 to 3 million tons of material suitable for cement to a depth of 100 ft. in this one occurrence.

An average sample from portion 106, where perhaps the best marble (as regards colour and texture) occurs, gave—

	Per cent.
Loss on ignition	43.0
Insolubles	1.2
Fe_2O_3 and Al_2O_3	0.6
CaO	54.7
MgO	0.3

Marble has been quarried at Lucky Valley for building, monumental, and terrazzo work.

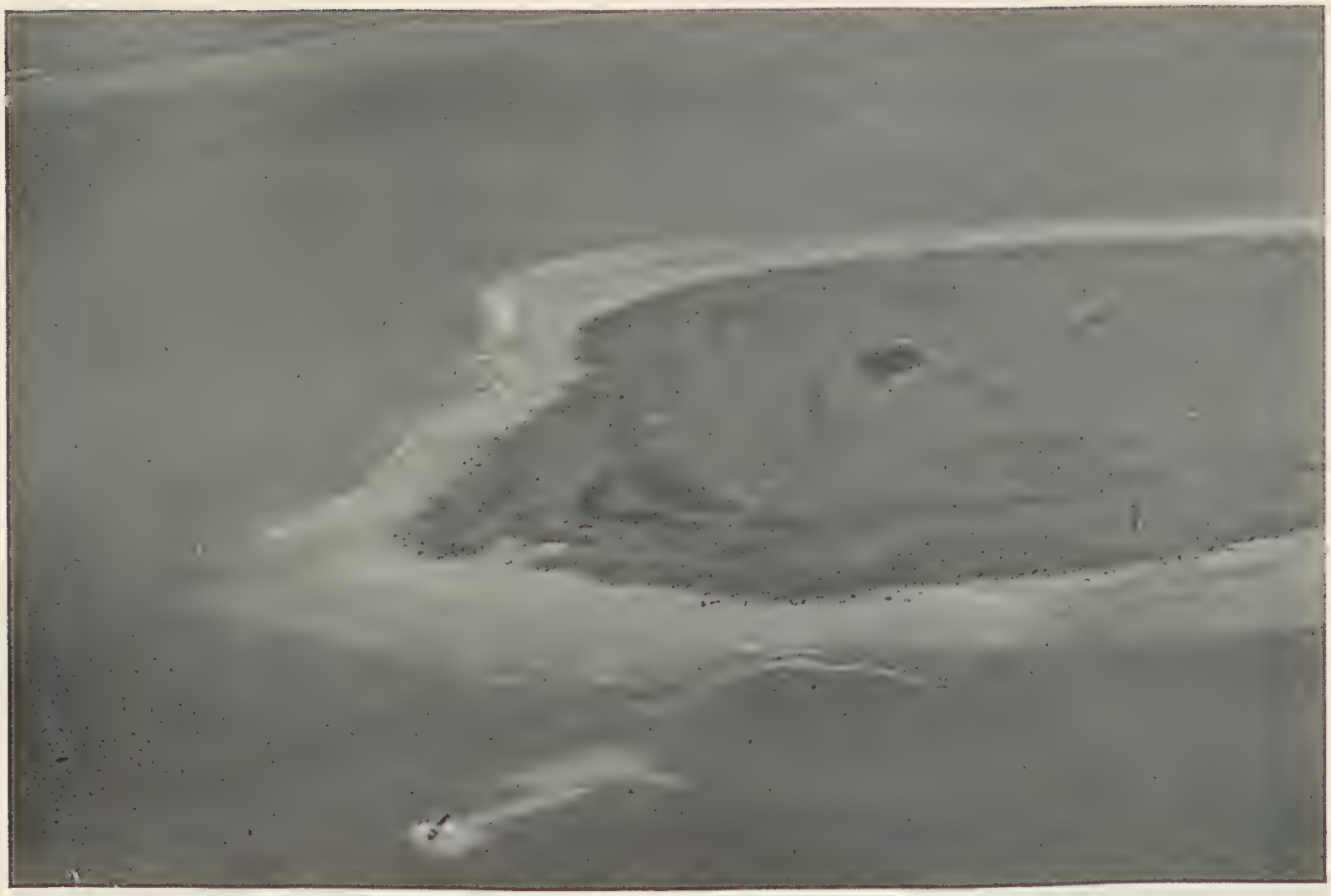
Age: Devonian.

(B) Silverwood (11 miles by rail south from Warwick).

In the area adjacent to the railway between Morgan Park and Cherry Gully, and centred about Silverwood, a number of discontinuous lenses of coralline limestone occur, some of considerable size, over a length of 9 miles. The limestones are enclosed in andesitic rocks, striking NNW.

There are several lenses adjoining Rosenthal Creek, from near Morgan Park in the north to about 4 miles south of Silverwood, and within 1 to 1½ miles in a direct line westerly from the railway. Other lenses occur near Oaky Creek to the east of the railway and within 2 miles from Omoral railway station.

Considerable tonnages of limestone have been won and burnt for lime from Locke's quarry in portion 508, parish Rosenthal, (2 miles south of Silverwood), and at Grieve's quarry in portion 660, parish Rosenthal, (4 miles south of Silverwood), both near Rosenthal Creek. At the latter place, limestone outcrops over a length of 300 yd., and a width of 30 ft. was exposed some 40 years ago, when



Dredging coral debris at Mud Island, in Moreton Bay, for cement works at Darra.
—*Photo. Queensland Cement and Lime Co. Ltd.*

it was stated that an 80-ft. quarry face could be obtained above creek level. A sample from this occurrence gave—

	Per cent.
Moisture	0.1
Loss on ignition	42.6
SiO_2	0.8
Fe_2O_3	0.3
Al_2O_3	0.9
CaO	54.1
MgO	0.2

Smaller amounts of limestone have been obtained from quarries 1 mile north of Silverwood and from near Limestone Siding 3 miles further north.

Age: Lower Devonian.

(B) Silver Spur (7 miles east from railway at Texas).

Limestones occur in several belts, mostly of relatively small extent, in the sedimentary beds about Silver Spur, at Glenlyon 12 miles to the ENE., and at Kilminster further to the east, 6 miles west of rail at Ballandean.

A large outcrop occurs 2 miles NW. of Silver Spur, and other outcrops are 6 miles north of the town and 4 miles to the east. The outcrops 6 miles to the north of Silver Spur extend over an area at least 1 mile in diameter, and occur over a wide flat, but the exact extent is not known. The area includes slates and ironstones.

Age: Permo-Carboniferous.

2. Brisbane District.

(A) Moreton Bay.

Subfossil reef coral debris occurs in the vicinity of several islands in Moreton Bay. It is partly exposed at low tide, and at Mud Island is known to extend to a depth of about 25 ft., where it rests on mud. It is dredged at this island for use, in place of limestone, in cement manufacture. Drilling there has proved 50 million tons of material suitable for this purpose. Reserves at other islands have not been assessed.

Coralline material dredged at Mud Island ranges from 70 to 92 per cent. $CaCO_3$ and averages about 86 per cent. A typical analysis is—

	Per cent.
Loss on ignition	40.11
SiO_2	6.57
Fe_2O_3	0.80
Al_2O_3	2.12
CaO	48.07
MgO	1.17

Age: Recent.

(C) Pine Mountain (7 miles NNW. from Ipswich).

Small occurrences of bedded limestone are known near Pine Mountain. Brownish impure limestone occurs about 1 mile N. of Pine Mountain railway station, and grey limestone outcrops about 2 miles north of the station.

Cherty magnesian limestone also occurs in the district as a secondary product.

Age: Lower Palaeozoic.

Unloading and transporting coral at Oxley Wharf.

—Photo. Queensland Cement and Lime Co. Ltd.

(C) Ottaba (7 miles N. of Esk).

Lenticular bodies of coarsely crystalline calcite erratically distributed in tuffs, agglomerates and rhyolites of Lower Triassic age, occur in portion 28v, parish Biarra, 1¾ miles by road SW. of rail at Ottaba. Sporadic outcrops occur over a distance of some 900 ft. from near the crest of a 260 ft. hill in a north-easterly direction to Coal Creek. Thicknesses up to 20 ft. have been reported, but there is little doubt that the calcite forms discontinuous lenses that are unlikely to persist individually to any depth. The exposures are not suggestive of commercially important reserves.

Limited quantities of calcite have been won for grinding, and as a war-time substitute for shell-grit. The coarsely-crystalline nature renders it unsuitable for lime-burning.

3. Gympie District.

(A) Tamaree (5 miles by rail north of Gympie).

Extensive deposits of limestone outcrop over an area of some 200 acres, lying immediately to the north of the railway with Tamaree station opposite the centre of the area. The most important deposit lies about ¼ mile ENE. of Tamaree.

The limestone occurs interbedded with altered shales and sandstone striking NE. and dipping to the SE. at 8–15 deg. The deposits seem to be local, and cannot be traced far in any direction.

Depth of overburden is a troublesome factor in quarrying. The limestones are irregularly traversed by silica veins up to 6 in. across. Small areas of good quality stone were available, and as low as 2 per

Main Quarry, Tamaree—1st lift 30 feet, 2nd lift 30 feet.

—Photo. W. H. Runge.

Queensland Cement and Lime Company, Darra, near Brisbane. Concrete silos holding bulk cement. —*Photo. Queensland Cement and Lime Co. Ltd.*

cent. SiO_2 could be obtained, but many years' quarrying has removed most of the available better-grade stone.

A sample from a 50-ft. working face gave—

	Per cent.
Moisture	nil
Loss on ignition	36.3
SiO_2	13.5
Fe_2O_3	0.9
Al_2O_3	1.7
CaO	45.5
MgO	0.4

The deposit was investigated by a Brisbane cement-manufacturing firm who found it unsuitable for their purposes, presumably because of lack of uniformity of grade. It is safe to assume that there are enormous quantities here, of unknown quality.

Limestones also exist 3 miles SW. from Tamaree, but the stone contains a high percentage of silica. A sample analysed—

	Per cent.
Moisture	0.3
Loss on ignition	23.1
SiO_2	38.0
Fe_2O_3	2.1
Al_2O_3	4.8
CaO	29.6
MgO	0.1

Age: Permo-Carboniferous.

(B) Curra (8 miles by rail north of Gympie).

Four miles from the railway at Curra, a large bed of limestone stated to be 50 ft. thick has been worked to some extent in an open-cut along the outcrop, and there is here a fair quantity of easily quarried stone. An analysis showed—

	Per cent.
Moisture	nil
Loss on ignition	40.5
SiO_2	5.1
Fe_2O_3	0.8
Al_2O_3	0.8
CaO	51.0
MgO	0.2

Curra Quarry Face, about 18 feet high and 60 feet wide. —*Photo. W. H. Runge.*

The deposit was once used for lime-making, but was abandoned in favour of others more favourably situated. Quarrying has recently been re-commenced.

Age: Permo-Carboniferous.

(C) Gympie.

At Gympie a belt of limestone outcrops on the eastern side of the goldfield. In places the stone is fairly free from impurities, but generally it contains too much silica to be of any use. The deposits lack the advantage of natural quarry sites.

Samples from the old cemetery, near the railway station contained from 28 to 37 per cent. of silica.

Age: Permo-Carboniferous.

(C) Marodian-Yorkey's.

A belt of highly altered limestone occurs 12–15 miles south of Gigoomgan, on the Marodian and Yorkey's Goldfields, about 12 miles north from Kilkivan railway station.

On the eastern side of this area, towards Munna Creek, there is a well-defined belt of limestone striking NNW. (and forming a probable extension of the Paradise-Degilbo occurrences). The rock is metamorphosed—the purer parts to marble, the more impure to wollastonite and garnet.

Age: Permo-Carboniferous?

(C) Kilkivan.

A small occurrence of chemically-deposited limestone in Lower Palaeozoic serpentinite on portion 426, parish Kilkivan (6 miles by road from the town) is exposed in a quarry 30 ft. x 15 ft. x 12 ft. and may yield a few hundred tons of stone. The better stone contains about 4 per cent. insolubles.

(C) Barambah (Murgon).

A large outcrop of light-coloured crinoidal limestone of fine quality occurs in portion 65, parish Murgon, 5 miles SE. of Murgon railway station. It appears to be a steeply dipping bed, and extends over a minimum area of 8 acres. At least three other lenses are known adjoining Barker Creek in subdivision 46 of portion 67, parish Barambah. One of these at least 10 chains long, forms cliffs along Barker Creek suitable as a quarry face, but is not so readily accessible, and continuous operations might be threatened by flooding. The limestone is marmorized in part, and is associated with slates and schists.

A quarry has lately been opened in portion 65, and small quantities of limestone and marble sold for agricultural use.

An average analysis of shipments is—

	Per cent.
Loss on ignition	43.8
SiO_2	0.3
Fe_2O_3 and Al_2O_3	0.1
CaO	55.6
MgO	0.4

Age: Lower Palaeozoic.

4. Maryborough District.

(A) Biggenden-Degilbo.

Outcrops of limestone extend for some distance north and south of the railway between Biggenden and Degilbo.

There are numerous outcrops about Mounts Biggenden and Hastings, 4 to 5 miles SW. of Biggenden. Another outcrop, in which some quarrying has been done, occurs just north of the railway 1 mile easterly from Degilbo.

Though large quantities of stone sufficiently pure for lime-making are available, much of the limestone is rather impure. The limestones near the old Mount Biggenden mine are often garnetiferous.

A general sample from the old quarry 1 mile east of Degilbo analysed—

	Per cent.
Moisture	0.1
Loss on ignition	39.3
SiO_2	6.7
Fe_2O_3	1.0
Al_2O_3	2.2
CaO	48.9
MgO	0.6

Limestone was once produced near Biggenden for agricultural use.

At Didcot, 12 miles west of Biggenden, a deposit of earthy lime has been opened up over an area about 2 chains square on portion 79, parish Degilbo, some 2¼ miles from rail. It appears to be derived by weathering of andesitic rocks, and possibly extends over an area of at least 10 acres under a shallow black soil cover. Earthy lime and hard nodules have been worked irregularly to a maximum depth of 6 ft., where andesite is exposed. A face sample of earthy lime analysed—

	Per cent.
Loss on ignition	29.5
SiO_2	7.6
Fe_2O_3	11.4
Al_2O_3	2.2
CaO	48.0
MgO	0.6

Age: Permo-Carboniferous.

(B) Paradise (8 miles NW. of Degilbo railway station on the south side of the Burnett River).

On the north-east side of Scrubby or Paradise Creek near its junction with the Burnett, there are ridges containing thick beds of a white to grey crystalline limestone running NNE. Nearer the creek another bed of limestone trending northerly is visible. The limestone appears to be interbedded with slates which dip steeply to the west.

Outcrops in this area are not very conspicuous. Though not a major deposit, it is believed that considerable reserves are available. A quarry is now operating here (1956).

The limestones here are probably a continuation of the belt between Biggenden and Degilbo. Samples of limestone from the Paradise area gave—

—	Parry's Selection.	Burnett River.
	Per cent.	Per cent.
Moisture	trace	trace
Loss on Ignition	42·0	42·3
SiO_2	2·7	2·0
Fe_2O_3	0·7	0·6
Al_2O_3	0·9	0·6
CaO	53·4	54·0
MgO	0·5	0·4

Age: Permo-Carboniferous.

(B) Marule (15 miles west of railway at Childers which is 40 miles from Maryborough).

A geological reconnaissance in 1914 indicated that extensive deposits of limestone are exposed, outcropping here and there for several miles along a defined belt. The deposits are stated to be favourably situated for economic quarrying. No estimates of available reserves have been made.

Three samples analysed—

—	Willie Creek.	Cliff Section.	Sandy Creek.
	Per cent.	Per cent.	Per cent.
Moisture	0·5	nil	0·9
Loss on Ignition	37·2	37·0	33·1
SiO_2	11·7	12·1	15·4
Fe_2O_3	0·8	1·7	2·6
Al_2O_3	2·3	1·8	4·0
CaO	47·0	47·2	43·1
MgO	0·5	0·9	0·9

Age: Permo-Carboniferous.

(B) Gigoomgan (10 miles south of Brooweena which is 36 miles by rail from Maryborough).

Very large deposits of fossiliferous limestone occur in thick beds at Gigoomgan and Glenbar, 5 miles to the east. At Gigoomgan a great mass of bluish-grey algal limestone forms large outcrops which can be traced for a distance of at least 14 miles along a NNW. direction. The main mass, with an average dip of 45 deg. to the west, measures approximately 1,100 ft. in thickness.

The limestone is said to be of very good quality, though in places varying degrees of purity from marble to calcareous shale are encountered.

Distance from railway is a serious drawback to economic development.

Age: Permo-Carboniferous.

5. Mundubbera District.

(B) Philpott Creek (109 miles by rail from Maryborough).

Within a few hundred yards of the railway at Philpott, 4 miles east of Mundubbera, extensive deposits of coralline limestone occur. Outcrops are not pronounced adjoining the line, but large quantities are available in the immediate vicinity.

An average sample showed—

	Per cent.
Moisture	0.1
Loss on ignition	42.8
SiO_2	1.4
Iron oxide	0.3
Al_2O_3	0.7
CaO	53.7
MgO	0.6

Age: Middle Devonian.

(C) Mundubbera.

To north and south of Mundubbera are small occurrences of limestone. Oolitic limestone with steep easterly dip, interbedded with calcareous grits, outcrops in portion 193, parish Mundowran, about 1½ miles NW. of Mundubbera. Impure limestones outcrop on portion 27, parish Mundubbera, 4 miles south of the town, on the opposite side of the Burnett River.

Further outcrops of coralline limestone, dipping westerly, occur interbedded with olive shales, on portions 19, 20, 21 and 22, parish Malmoe, 4½ miles WNW. of Mundubbera and 2 miles east of railway at Riverleigh.

Four miles further north, near O'Bil Bil, limestone is reported, with width of 20 ft.

This carboniferous belt extends northwards to Cannindah (q.v.) and may contain other lenses of limestone.

Age: Lower Carboniferous.

(C) Cracow.

Massive fossiliferous limestone forms a prominent outcrop ¾ mile NW. of Cracow Homestead, on the old Theodore-Taroom road. The limestone strikes somewhat west of north and appears to dip to the west at about 45 deg. It contains bands of silicified material. The maximum observed thickness of limestone is 350 ft. The limestone thins out very rapidly southwards, and after ¼ mile is non-existent.

Northwards from Cracow Homestead the limestone thins out within two miles.

Further north, flaggy limestones, with interbedded shales outcrop, in a road cutting near Orange Creek, 2 miles west of the Cracow goldfield. They dip westerly at 20–25 deg., and the total thickness of limestone and shale appears to be no more than 100 ft.

Limestones are also recorded near Delusion Creek some 6 miles further north.

Age: Permo-Carboniferous.

6. Bundaberg District.

(B) Dalysford (36 miles by rail WSW. from Bundaberg).

There are several comparatively small deposits of limestone within a distance of 5 miles SSE. of Dalysford railway station, on the Mount Perry line.

On portion 1317, parish of Walla, 5 miles SSE. of Dalysford, three main lines of limestone occur in the SE. corner of the portion, dipping at 45–60 deg. south-westerly. The main body of limestone is over a chain in width, and is traced for about 5 chains, tapering out to the north, and covered by alluvium

to the south. A quarry was opened to 15 ft. depth exposing 40 ft. of limestone with some bands of schist. The stone is bluish and in places very impure.

Another quarry, 15 ft. deep, 5 chains west of this, exposed a bed from 10 ft. to 60 ft. in width, with a length of 3 chains, dipping 50 deg. to the west.

Half-a-mile SW. of the above in portion 7v limestone with a width of 30 ft. and 3 chains in length was partly exposed in a small quarry.

Ten chains south of the last quarry, limestone 10 yd. across at the surface gave way abruptly at 15 ft. to slate.

Other outcrops are reported for several miles to the south.

In portion 1230, ½ mile west of the quarry in portion 1317, limestone striking N–S. and dipping west at 80 deg., occurs apparently as a replacement of slates on the north side of the WNW. fault. Outcrops occur for over 2 chains to the east. Some quarrying has been carried out.

Two miles SE. of Dalysford variously coloured, vertically-disposed limestone beds not more than 3 ft. in thickness have been proved.

These limestones, which are not fossiliferous, are believed to have been produced by replacement of slates.

A sample of limestone from Dalysford gave—

	Per cent.
Moisture	1.5
Loss on ignition	43.3
SiO_2	5.1
Iron oxide and Al_2O_3 ..	3.4
CaO	46.9
MgO	trace

Limestone has been quarried near Dalysford for smelting purposes; some has also been sent to sugar refineries.

Age: Probably Devonian.

(B) Goodnight Scrub (16 miles E. of Mount Perry and within 6 miles of railway at Morganville).

There are several occurrences of marmorized limestone here:—

(*a*) *Near Tenningering Creek.*

(1) Limestone Creek.—Limestone occurs in the form of a belt in schist country, striking 15 deg. E. of S. and dipping vertically.

A fairly massive outcrop of metamorphic limestone occurs at the junction of Limestone Creek and Tenningering Creek. The observed outcrop is 4 to 5 chains wide and can be traced from the north bank of the Creek for about 10 chains south. The width includes about 2 chains of "schisty" limestone apparently of impure quality. The stone is a crystalline marble of poor white to bluish colour. Its possible value as commercial marble has not been investigated.

Limestone is reported to outcrop again ½ mile to the north.

A sample from the large outcrop in Limestone Creek analysed—

	Per cent.
Moisture	0.1
Loss on ignition	43.4
SiO_2	0.6
Al_2O_3	0.4
CaO	55.1
MgO	nil
P	0.02

(2) Back Creek.—Limestone interbedded with schists outcrops on Back Creek, ¾ mile south of the Limestone Creek occurrences. The intervening country is scrub-clad.

This appears to be a distinct belt, ¼ mile west of the Limestone Creek belt.

The outcrop can be traced for 7 chains, and the greatest width is 4½ chains, but there is an intrusive tongue of diorite in one part of it.

A sample analysed—

	Per cent.
Moisture	0.2
Loss on ignition	42.4
SiO_2	0.3
Al_2O_3	0.2
CaO	55.1
MgO	nil
P	0.03

(*b*) *Kalliwa Creek.*

About 6 miles south of the Limestone Creek occurrence, limestone outcrops in the scrub reserve on the west branch of Bowden's Creek, probably in designed portions 82 and 83. It does not exceed 2 chains at its widest portion, but was traced by occasional outcrops about 6 chains north-south. The outcrop is a finely crystalline white to bluish limestone, interbedded with vertical schists striking N.–S. The stone might be suitable as commercial marble, though preliminary tests suggest an inferior quality.

A sample analysed—

	Per cent.
Moisture	0.3
Loss on ignition	43.3
SiO_2	0.6
Al_2O_3	0.3
CaO	55.1
MgO	nil
P	0.01

Age: Devonian?

(C) Rosedale (34 miles by rail north from Bundaberg).

Limestone occurs ½ mile from Native Dog Creek about 6 miles south of Rosedale railway station. A sample from here analysed—

	Per cent.
$CaCO_3$	98.88
SiO_2	1.12

Similar material was worked at Jones' Quarry near the railway station. An analysis of limestone from Jones' Quarry gave $CaCO_3$ 97 per cent.

7. Gladstone District.

(A) Ambrose (27 miles by rail north-west from Gladstone).

Quarry Face, Ambrose Lime Works Pty. Ltd.

Limestones outcrop over a gently undulating area of 8 acres in portion 25v, parish of Langmorn, a little more than ½ mile south of the railway at Ambrose station. It is considered certain that the limestone extends uninterruptedly over this area. The limestone is covered by dark-red soil from 1 to 5 ft. thick, and is stained externally for another 5 ft. but below that contains little impurity.

This area of outcrops is surrounded by a zone of red soil with sinkholes (10–30 ft. across and 2–10 ft. in depth), 30 chains long by 10 chains wide, which is believed to be underlain largely by limestone.

The strata are probably vertically disposed, and may have a greater vertical than horizontal extent.

It has been estimated that at least 1 million tons of limestone are available to 30 ft. depth within the area of 8 acres, and that larger quantities could be expected from the surrounding sinkhole zone. No testing has been done to establish reserves.

A sample of Ambrose limestone contained—

	Per cent.
Moisture	0.1
Loss on ignition	42.6
SiO_2	1.0
Iron oxide	0.5
Al_2O_3	0.7
CaO	55.1
MgO	0.1

Limestone has been quarried here for many years for lime-burning and lately for smelting at Mount Morgan. An area of about 1 acre has been worked to depths up to 20 to 30 ft.

Age: Coralline limestone of Lower Devonian age, presumably equivalent to part of the Etna Formation occurring around Raglan and Mount Etna.

(A) Calliope (16 miles by rail south from Gladstone).

There are numerous outcrops of limestone in a belt from 1 to 2 miles wide over a distance of 25 miles, extending from about 6 miles north of Calliope SSE. to the Boyne River and continuing to the Eastern Boyne River. This belt is traversed by the Many Peaks railway. (See also Boyne River.)

(*a*) Limestone outcrops in the eastern part of portions 77 and 103, parish of Calliope, 6 miles to the north of Calliope, 8 miles SW. of Gladstone, and within 2½ miles of the railway. Limestone is traceable for several chains to the north, with a width of about 2 chains. A small quarry was opened; the stone in the south-eastern part is pure, but in the north-east it is stained by iron. The rock contains indistinct corals and crinoids.

Quarry Face, Ambrose Lime Works Pty. Ltd.

Loading Stone in Quarry, Ambrose Lime Works Pty. Ltd.

(*b*) In the Calliope River, ¼ mile below the road crossing near Carrara Station, and 2½ miles SW. of the above, are several lenticular exposures of limestone, all within a radius of 10 chains. The rock continues northwards beneath alluvial soil cover. Outcrops here are up to 50 ft. wide, 25 ft. high, and 5 chains long. Much of the limestone is pure, but some is badly stained by iron. The stone varies in character and colour. Much of it is pure, and grades to light-grey marble with fine colouring.

(*c*) Limestones outcrop on portions 338 and 176, parish of East Stowe, 2 miles NNE. of Calliope, one belt being ¼ mile long and ½ chain wide and striking WNW.; on the head of Bedford Creek, 2½ miles SE. of Calliope; on Leixlip Creek, 2 miles SSE. of Calliope. There are numerous outcrops on the heads of Ten Men Gully and Brennan's Flat.

(*d*) The greatest development of limestone outcrops is between Raggote Creek, about 6 miles SSE. of Calliope, and the Boyne River at Marblestone, and within 2 to 3 miles of the railway. From portion 20v, parish Riverston, for at least 3 miles, limestone is almost continuous. The outcrops, striking NNW. usually do not exceed ¼ mile in length and owing to the development of separate lenses side by side the width is often as great as the length. The greatest development is on portion 2v, Riverston, beside the Calliope-Milton road, where the beds dip at 70 deg. to the east. The limestones are pale blue and mostly pure, and contain stromatoporoids and corals.

Age: Lower Devonian?

(B) Cania and Kroombit (20–25 miles NNW. of Monto railway station).

Oolitic limestones occur on both sides of the Dawes Range on the Kroombit-Cania road, as well as at several places in the vicinity of Cania township on both Four-Mile and Three Moon Creeks. The stone is light blue in colour and of very good quality.

One outcrop 3 miles west of Cania is 50 ft. thick and several chains in length.

Immense beds of fossiliferous limestone occur on Kroombit Creek, 5 miles above Kroombit Head Station. Exposures up to ¼ mile wide occur, and some of the cliffs on the creek are 50 ft. in height. The stone is pure.

Other altered limestones occur at the *Five-Mile* copper mines, 5 miles SE. of Kroombit.

Age: Lower Carboniferous.

(B) Cannindah.

A belt of massive fossiliferous oolitic limestones outcrops in the area between Mount Cannindah and

Ambrose Quarry, Ambrose Lime Works Pty. Ltd.

Monto, on both flanks of an anticlinal structure 6 miles wide. Near Monto it is interbedded with volcanic rocks.

The limestone forms striking ridges in the vicinity of Old Cannindah Station 6 miles SE. of Monto railway station and is also seen on the Monto-Waratah road 1¾ miles NE. of Monto, where it is much disturbed close to a fault. The general strike of this limestone horizon over a plotted length of 6 miles is NNW. with a dip of 60 deg to the west.

The same horizon occurs dipping easterly at 45 deg. on Splinter Creek and at New Cannindah Station 6 miles to the NE. Visible outcrops on portion 20, parish Cannindah, indicate a thickness of not less than 400 ft., the thickest recorded development in the State of oolitic limestone.

Other oolitic limestone beds, on a higher stratigraphic horizon, are recorded on portions 37 and 38, parish of Cannindah, 3 miles SW. of Kalpowar on the Many Peaks-Monto line. These are up to 90 ft. thick.

Three large beds of limestone are also recorded between Splinter and Kalonga Creeks to the north of New Cannindah in the same area. The stone on Kalonga Creek is pure, but most of that between Branch and Splinter Creeks is very impure.

Large outcrops of limestone are recorded at the Burnett River Crossing on the Cannindah-Mount Perry road, 20 miles SE. of Monto, forming a probable extension of the limestone belt outcropping at Old Cannindah.

Age: Lower Carboniferous.

(C) Boyne River-Many Peaks.

On the east side of the Boyne to the south of Marblestone, which is 3 miles east of Barmundu railway station, limestone outcrops occasionally in portions 22v, 6v, 7v, and 9v, parish Pemberton, over a distance of 4 miles. That in portion 9v is several chains in length and pure white and saccharoidal. The limestone has been altered by a large granite intrusion ½ mile to the east.

Other limestone outcrops occur further south between Littlemore and Many Peaks.

A 10-ft. bed of pure white limestone outcrops 2 miles north of the old *Many Peaks* mine, striking north-south.

A large outcrop lies ½ mile south of portion 10v, Milton. The bed is probably 2 chains wide and can be followed for a mile.

Age: Lower Devonian.

(C) Glassford Creek (west of Many Peaks).

Several outcrops of limestone occur in the vicinity of Glassford Creek township, 4 miles from railway. They occur both north and south of the town. The limestones have been altered by intrusion of granite, and probably are too siliceous for lime-making.

At Sandberger, 4 miles south of Glassford, and at Mount Hector, 6 miles north-west, similar altered limestones occur.

(C) Diglum (30 miles south from Gladstone, and 5 to 10 miles from railway at Barmundu).

On Diglum and Booreeco Creeks are several north-south belts of limestone at intervals of ½ mile, over an area 4 miles in diameter. Some of the limestones can be traced for over 1 mile. They are in places saccharoidal and in others much altered by granite intrusions.

(C) Catfish (21 miles SW. of Gladstone, and 12 miles west of railway at Calliope).

A number of fossiliferous limestone outcrops occur from Catfish Creek for 3 miles to the NE., striking west of north. The beds are up to 1½ chains in width and ½ mile in length, and the greater part is rather impure, though much is suitable for lime-making.

Outcrops of a pure white marble occur on the Calliope River in portion 1, parish West Stowe.

Other outcrops of marble occur on Mount Grim on portion 2v, parish Alma, 31 miles west of Gladstone.

8. Callide Valley.

(C) Thangool (109 miles by rail SSW. from Rockhampton).

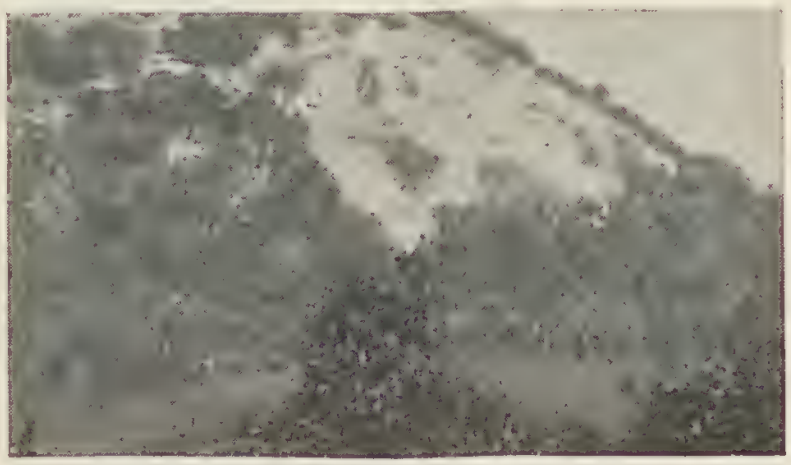
Massive beds of limestone occur 1 mile west of Prospect Peak, 22 miles by road SSW. of the railway at Thangool, folded on NNW. axes and dipping steeply.

Age: Permo-Carboniferous.

9. Rockhampton District.

(A) Mount Etna-The Caves (15 miles NNW. of Rockhampton, and within 1–2 miles of the railway line).

Ridges of coralline limestone form a prominent feature in the neighbourhood of Mount Etna and form one of the State's major areas of limestone resources. The ridges stand out to heights of 150–300 ft. and here and there are large bluffs of limestone. The limestones are interbedded, together with shales and cherts, with rhyolites and tuffs.



Limestone Outcrop, Mount Etna, near Rockhampton.

There are three main areas—(1) adjoining Mount Etna, in which are Johannsen's Caves; (2) Pilkington's deposit, ¾ mile east of Mount Etna, and (3) Olsen's Caves, 2 miles east of Mount Etna.

(1) The northern portion of Mount Etna is a mass of coralline limestone extending from R. 444 into portion 120. The width of limestone is irregular but from north to south it outcrops over a distance of at least 30 chains, half of which is in portion 120. Limestone forms hills in portions 94v and 2371 and in R. 272.

The limestone is a body of immense size and on the northern slope of Mount Etna there is a steep limestone face some 300 ft. high, which is admirably suited for quarrying. Behind this face is a series of four caves. It is considered that it should be possible to quarry at least a million tons of limestone without interfering with any of the caves except one (J.H.R.). The limestone is said to be higher in magnesia than the other deposits mentioned.

(2) The limestone lens worked at present, which is separate from that on Mount Etna, has a length of 1 mile and maximum width of ¼ mile.

The limestone is overlain by indurated shales but the exact relationship is not established. The limestone forms a ridge rising to over 300 ft. in height and is very favourably situated for quarrying. The present quarry face has a maximum height of 190 ft. Reserves above present quarry datum have been estimated at 33 million tons and there are further large prospective reserves below that level.

Samples from the quarry show the following range in composition—

	Per cent.
SiO_2	0.50– 1.35
Fe_2O_3	0.12– 0.20
Al_2O_3	0.25– 0.46
CaO	54.4 –55.0
MgO	0.03– 0.09

(3) There is another large area of limestone about Olsen's Caves, about 1 mile x ½ mile in extent.

Two analyses are available—

—	(1) near the Hotel (?Caves Hotel South-West of Olsen's Caves).	(2) Olsen's Caves.
	Per cent.	Per cent.
Moisture	0·2	0·2
Loss on Ignition	42·1	41·6
SiO_2	1·7	2·5
Fe_2O_3	0·3	0·3
Al_2O_3	0·9	1·2
CaO	54·1	53·8
MgO	0·3	0·2

Several other smaller limestone areas have also been noted in this district.

Limestone has been quarried in this area for many years to supply the local market for agricultural lime and for smelting at Mount Morgan.

Age: Coralline limestone of Lower Devonian age.

(A) Marmor (26 miles by rail south-east from Rockhampton).

Crinoidal limestone near Marmor railway station, has been extensively worked for many years for flux for smelting at Mount Morgan and for lime-burning, over 1½ million tons having been already extracted.

A deposit of earthy limestone in this area has been worked for agricultural purposes.

A sample of powdery lime from portion 89, parish San Jose, 2 miles north of Marmor analysed 51·3 per cent. CaO.

The limestone is included in the Etna Formation (Lower Devonian) which has been traced from Mount Etna to Raglan and contains numerous and large lenses of limestone. No detailed testing has been done at Marmor, but considerable quantities are assured.

An analysis of Marmor limestone gave—

	Per cent.
CO_2	41.89
Organic matter	0.84
SiO_2	2.81
Fe_2O_3	0.32
Al_2O_3	0.46
CaO	53.26
MgO	0.30
SO_3	0.38
P_2O_5	trace

Age: Lower Devonian.

(A) Raglan (34 miles by rail southerly from Rockhampton).

Limestone outcrops about 4 miles SW. of Raglan railway station (5–6 miles by road), in the southern corner of State Forest R. 99 and in portion 43, parish of San Jose.

The limestone belt is at least 20 chains wide. Its extent has not been determined, but it may continue for some miles in a N–S direction. Large quantities of easily quarried limestone of good quality are available here. The hill in R. 99 would appear to offer the greatest scope for economical working on a large scale.

In R. 99, grey limestone forms a hill rising about 200 ft. above the general level of the country, and covering at least 50 acres. North of this and separated from it by a saddle, lies a ridge of equal altitude, the eastern portion of which is also composed of limestone.

An average chip sample from a 20-acre area forming the apex of the hill on R. 99 analysed—

	Per cent.
Loss on ignition ..	42.5
CaO	53.3 (= 94.9 per cent. $CaCO_3$)

Immediately to the south, in portion 43, a bluff-like outcrop of grey coralline limestone occurs in scrub country along the northern fall of a ridge 50 chains west of Horrigan Creek, the outcrop covering 2 acres. Cave structures occur through this outcrop. An average sample of the outcrop gave—

	Per cent.
Loss on ignition ..	43.8
CaO	54.5 (= 97.3 per cent. $CaCO_3$)

About 30 chains east from this, another outcrop of apparently similar coralline limestone occurs on a small hillock, distinctly dark in colour, striking NE.–SW. and dipping almost vertically. Numerous small inclusions of bluish siliceous material frequently accompany the fossil corals. An average sample (excluding the fossil structures) gave—

	Per cent.
Loss on ignition ..	42.0
CaO	54.1 (= 96.9 per cent. $CaCO_3$)

In portion 47, adjoining the above and on the opposite (east) side of Horrigan Creek, a well disclosed similar limestone below 63 ft. of alluvium.

Near Raglan Creek, to the east of the railway, a bed of crinoidal limestone occurs striking north-south and dipping to the west at a high angle. This limestone forms a series of low ridges which have been traced to the foot of Mount Holly, 5 miles to the south.

Limestones are also reported to outcrop near Langmorn, 10 miles SSW. of Raglan.

Limestone has been quarried at Raglan for agricultural lime and for sugar-refinery use.

Age: Coralline limestone forming the lower beds of the Etna Formation of Lower Devonian age.

(A) Glenmore.

(*a*) An area of limestone occurs adjoining the railway line, ½ mile south of Limestone Creek siding, and 3 miles north of Rockhampton, on portions 120 and 121, parish of Murchison. The limestone, which is almost vertical has a maximum width of 450 ft. and an exposed length of 15 chains. It is estimated that the tonnage available for quarrying to a depth of 100 ft. is of the order 5,000,000 tons. The limestone is grey and fossiliferous. Beyond occasional bands of earthy material, it appears to be massively bedded limestone of apparently good quality. It has suffered some igneous intrusion on its western side, though without detrimental effect to its quality. A sample taken over width of 1 chain in an old quarry on the eastern side of the deposit gave—

	Per cent.
CaO	54.5
MgO	1.1

Quarrying operations have been carried out to a depth of 15 ft., and have removed some 2,000 tons of stone.

(*b*) A larger area of limestone occurs beside the Fitzroy River, 1 mile west of the railway at Limestone Creek siding, and 27 chains in maximum width, and is believed to contain immense quantities of limestone. Reserves above river level, however, are limited. Some stone was worked many years ago, but quarryable reserves have not been determined. The stone is grey, massive, and in places fossiliferous.

Two samples from outcrops in the northern part of the area gave respectively 95·1 per cent. and 96·2 per cent. $CaCO_3$.

Age: Lower Devonian.

(A) Duke Group of Islands.

These form part of the Northumberland Group, lying half-way between Mackay and Rockhampton, and 8 miles NE. of the nearest point on the mainland, and 12 miles from Stanage Point. Limestone occurs on three islands of the group, interbedded with steeply dipping and folded slates and tuffs.

Mortar Island (about 8 acres).

Limestone occupies a large proportion of the Island. It is divided into two sections by a band of metamorphics 40 ft. to 50 ft. wide.

The limestone forms steep cliffs rising abruptly from the sea up to 70 ft. high. Inland the maximum height is 120 ft. The stone is partly marmorized, pink, white, and blue colours predominating.

A representative sample gave—

	Per cent.
Loss on ignition	43.5
SiO_2	0.9
Fe_2O_3 and Al_2O_3	0.5
CaO	55.1
MgO	0.0

Marble Island (2 sq. miles in area).

The only deposit of commercial importance occupies a triangular area of about 1¼ acres on the north-western point. From a terrace just above high-water mark limestone cliffs rise to a plateau with maximum height of 50 ft.

The limestone has been marmorized, the marble varying in colour from pink to white and bluish-grey.

A sample of the limestone showed—

	Per cent.
Loss on ignition	43.0
SiO_2	1.8
Fe_2O_3 and Al_2O_3	0.8
CaO	54.4
MgO	0.0

On the extreme southern end of the island is a rock resembling conglomerate and composed of boulders of marble; it is unfit for lime-making.

Hunter Island.

There are four separate occurrences of limestone and marble on the north-eastern part of the island—

(i.) Favosites Point.—Variously coloured marmorized limestone occurs over a roughly circular hill with diameter of 400 ft. rising to a height of 85 ft. An analysis showed—

	Per cent.
Loss on ignition	43.0
SiO_2	1.0
Fe_2O_3 and Al_2O_3	0.8
CaO	55.0
MgO	0.0

(ii.) Limekiln Beach.—Variegated coloured marble outcrops over an area of 400 x 300 ft., but it is probable that it is a comparatively thin bed overlying slates and dipping easterly with the hill-slope. It is cut off on the south by a fault. Limited quantities of ornamental marble are available, but subsurface exploration is necessary to establish appreciable reserves.

(iii.) Silica Hill.—A bed of blue limestone some 400 ft. thick, with steep easterly dip, occupies the whole of the western side of this hill and extends, because of folding, over part of the northern slopes, where it merges into pink and green mottled marble. The limestone rises to a maximum height of 180 ft. above sea level.

Analyses are as follows:—

—	Northern Section full width.	Central Section full width.
	Per cent.	Per cent.
Loss on Ignition	43·0	41·4
SiO_2	1·9	4·6
Fe_2O_3 and Al_2O_3	0·8	1·6
CaO	54·0	51·9
MgO	0·4	0·6

(iv.) Verde Antique Point.—A small lens of limestone outcrops over an area of about 1 acre. Limestone cliffs rise to a height of 20 ft. from a

terrace composed of metamorphics, from which it is concluded that the limestone does not extend below sea level.

A representative sample analysed—

	Per cent.
Loss on ignition	42.5
SiO_2	2.6
Fe_2O_3 and Al_2O_3	1.3
CaO	53.2
MgO	0.5

Reserves in these deposits have been estimated by survey and levelling, as follows:—

—	Total Available above H.W.M.	Available above 20-ft. contour.
	Tons.	Tons.
Mortar Island	660,000	490,000
Marble Island	120,000	40,000
Hunter Island—		
Favosites Point	250,000	110,000
Silica Hill	1,960,000	1,440,000
Verde Antique Point	120,000	60,000
	3,110,000	2,140,000

(B) Ulam.

A belt of crystalline limestone, including white saccharoidal marble of medium to rather coarse texture occurs in a generally rugged and scrub-clad area 2½ miles long and 1 mile wide, at South Ulam, from 8½ miles to 11 miles (14–15 miles by road) SSE. of Bajool railway station. The belt culminates in the north in Mount Kelly and Mount Camley, and flanks the eastern side of the Eight-mile Creek valley.

Several persistent beds of white crystalline limestone are contained in metamorphic rocks, which have been intruded by numerous basic dykes, which have to a large extent destroyed the marble deposits, especially at the northern end of the belt. To the south of the main area of limestones, the metamorphics contain only isolated small lenses of crystalline limestone. Limestones are reported on Bald Hill, 7 miles south of Mount Kelly.

The marble bed has an almost vertical attitude, and is estimated to be no less than 1,000 ft. thick, so that continuity in depth, to the limit of quarrying operations, is assured.

At the northern end of the belt, white marble is exposed over a vertical distance of more than 200 ft. in the very steep northern side of the gap between Mount Kelly and Mount Camley, and at Mount Kelly a vertical range of over 600 ft. has been proved. Many millions of tons are available in these deposits.

Because of the rugged nature of the northern end of the belt and the presence of dykes there, the southern end alone offers suitable but restricted areas for exploitation of marble.

An average sample of marble from a lease in portion 22, parish of Raglan, gave—

	Per cent.
Moisture	0.1
Loss on ignition	43.8
Insolubles	0.2
Al_2O_3	0.2
Iron oxide	trace
CaO	55.3
MgO	0.4

These deposits provide one of the few statuary marbles in the Commonwealth.

Marble has been quarried at Ulam for building, monumental and terrazzo work.

Age: Devonian.

(B) Bajool.

Soft white chalky limestone occurs on the southern side of the Gladstone road about 2 miles from Bajool railway station.

It is reported that prospecting of the deposit in 1926 revealed an extent of some 13 acres, with depth varying from 18 to 20 ft., beneath an overburden of 1 ft. of black soil. The quarried material analysed 87 per cent $CaCO_3$.

This and smaller similar deposits in the Rockhampton district, have been quarried for local agricultural use.

Age: Recent.

(B) Mount Morgan.

Several occurrences of fossiliferous limestone are known in the country within 5 miles to the east and south of Mount Morgan, interbedded with sediments and volcanics (both flows and agglomerates) with a general NNW. strike.

The largest deposit known is at the head of Station Creek, some 3 miles ESE. of the town (8 miles by road), in portions 752 and 753 and R. 462, parish Plews, where limestone outcrops discontinuously over nearly ½ mile. The stone varies from a grey limestone to white saccharoidal marble and is of good quality. Investigation by Mount Morgan Ltd., who hold the deposit, indicated a considerable thickness. It has been quarried on a small scale. A smaller similar deposit occurs at the head of Limestone Creek on the opposite (west) side of the divide.

Limestones occur at Glen Dee, on the Dee River, 4 miles ENE. of Mount Morgan, where they have been affected by granitic intrusions. An outcrop on the east side of Mount Keys is 14 ft. wide and has been traced for some distance.

About 3½ miles SSE. of Mount Morgan, beyond Hamilton Creek, there is a fairly large deposit of crystalline limestone outcropping in the hills on both sides of the road. It may be siliceous. Some quarrying has been done.

Age: Middle Devonian to Lower Carboniferous.

(C) Stanwell (Lion Creek) (15 miles by rail west of Rockhampton).

A belt of coralline limestone occurs about 5 miles north by west of Stanwell railway station and is cut transversely by Lion Creek. Much of the limestone is oolitic, and in places it is silicified. It is interbedded with conglomerates, sandstones and shales, and dips SW. at 40–45 deg. Its full extent has not been traced. The thickness is in places about 15 chains, but the belt is probably irregular in thickness and extent.

Age: Carboniferous.

(C) Mount Chalmers (19 miles by rail north of Rockhampton).

Limestones occur near Cawarral to the north-east of Mount Chalmers, and near Tungamull to the east. There has been a small production from Cawarral and from Tungamull.

A sample of limestone from Tungamull gave on analysis—

	Per cent.
Silica and insolubles ..	0.32
CaO.	54.60

Age: Lower Palaeozoic.

(C) Morinish (some 10 miles west of railway at Ridgelands which is 19 miles WNW. from Rockhampton).

Between the Morinish goldfield and Ridgelands limestones occur with slates. The limestones are in places altered by granitic intrusions to garnet rock.

Near the western boundary of the Morinish goldfield limestones are recorded on G.S.Q. manuscript map, but no particulars concerning these occurrences are known.

At Mount Cassidy, some 8 miles west of the Morinish goldfield, on portion 20, parish Aricia, limestones occur interbedded with shales, overlying volcanic rocks which strike N. 30 deg. W. and dip NE. at 35–40 deg. Detailed mapping of the area has not been carried out.

Age: Middle Devonian.

(B) Yatton (40 miles WSW. of St. Lawrence).

A limestone belt up to at least 220 ft. thick, and probably much more about Yatton, containing coralline and massive crystalline non-fossiliferous limestones extends SSE. from Lotus Creek, about 20 miles north of Yatton Station. It first becomes particularly noticeable at Croydon Station, and forms well-defined ridges which skirt the Yatton goldfield and Mount Bora, and pass beyond Clive Creek to the south of Yatton.

Three miles SW. of Yatton a scrubby hill top is capped by limestone dipping to the SSE. at 45 deg. In a creek bed near Mount Bora limestone dips at 30 deg. easterly.

The distance from railway is a serious disadvantage.

Age: Permo-Carboniferous.

10. Emerald District.

(C) Springsure-Carnarvon Area.

Limestone beds, often impure, occur in the Permian rocks within 50 miles to the south and west of Springsure.

At Dilly, a few miles north of Springsure a bed of fossiliferous limestone 15 ft. thick is interbedded with shales.

Limestone, associated with calcareous shales, occurs on a small rounded hillock 1 mile east of Mount Serocold.

The limestone-bearing sequence occupies a corridor 2–3 miles wide between cliffs of sandstone for some 16 miles northwards from Consuelo Creek.

Limestone is known also on the eastern slopes of a hill 3½ miles west of Wealwandangie (20 ft. thick), in the Vandyke-Spring Creek area and at Nardoo, Mantuan Downs, Fairview and Alpha Stations.

Age: Permo-Carboniferous.

(C) Clermont.

Several occurrences of limestone are known in the Clermont district.

Near Douglas Creek, about 8 miles south from Clermont, there are four known outcrops of limestone striking NNE.—

(1) Portion 73, parish Copperfield.

(2) Portion 85, parish Copperfield, both on the left bank of Douglas Creek.

(3) Selection 75, on the right bank of the Douglas (present portion number not known).

(4) Portion 9, parish Theresa.

The limestone is usually dark in colour and partly crystalline. Where quarried it was free from silica. The stone has been quarried for lime-making.

Limestone is also reported to outcrop on Drummond Creek, 3 miles south of Copperfield.

Age: Middle Devonian.

11. Mackay District.

In the Cape Hillsborough-St. Helens area, some 20 miles NW. of Mackay there are several occurrences of limestone, none of which, however, offers prospects of large reserves.

(C) Cape Hillsborough.

On the SE. side of the Peninsula is a small lens of dark-grey oolitic fossiliferous limestone interbedded with andesitic tuff.

Age: Lower Carboniferous.

(C) Seaforth (Springcliff), on the coast.

Thin lenticular beds of impure limestone are interbedded in 50 ft. of calcareous sandstone dipping SW. at 25 deg. and outcropping about high-water mark on the beach one mile north of Seaforth. Quarryable reserves are negligible and the occurrence offers no commercial possibilities.

A sample from small isolated exposures on a flat alluvial ridge at Victoria Creek Jetty site contained 47·5 per cent. CaO.

Age: Lower Carboniferous?

(C) St. Helens (within 5 miles of rail at Calen).

A 10 ft. bed of fossiliferous oolitic limestone forms a conspicuous outcrop and is interbedded with andesitic tuffs near Home Creek, east of old St. Helens Homestead. It appears to dip steeply to west of south.

Age: Lower Carboniferous.

Repulse Islands (20 miles north of Seaforth).

Limestone of good quality is reported to occur on one of these Islands in fair quantity, but the deposits have not been inspected. Between 1911 and 1916 attempts were made to work them for local agricultural use, but failed through difficulties of access and loading and lack of water supply on the Island.

12. Bowen District.

(C) Ben Lomond (18 miles SE. of Bowen, at the SE. end of Edgecumbe Bay, near the mouth of the Gregory River).

A partially denuded lense of blue-grey uniformly fine-textured oolitic limestone outcrops at the NW. foot of the mountain. Detailed mapping has shown that the limestone, which is in the form of a roof-pendant in granite, occupies a roughly triangular area of about 2 acres with a vertical range of about 80 ft.

The limestone is probably underlain by granite at shallow depth and whilst there are undoubtedly useful quantities available, there is no expectation of large reserves. Testing would be necessary to establish the depth of limestone.

The deposit is within 8 miles of railway, but a road would have to be formed for part of this distance. Transport by sea would be hindered by the shallow water landing.

A typical analysis of surface stone is—

	Per cent.
Moisture	0.05
CO_2	40.6
Organic matter	0.6
Siliceous insolubles	4.5
Fe_2O_3	0.4
Al_2O_3	0.5
CaO	52.2
MgO	0.8
Pyrite (FeS_2)	0.2

Age: Upper Middle Devonian or Lower Carboniferous?

(C) Port Denison.

Coral and coral rock have been reported to occur on Stone and Middle Islands and coral mud on the foreshores near Mount Bramston, but none of these deposits has been investigated.

(C) Others.

At least two other occurrences of limestone are known in the Bowen district. At Police Camp on the Don River, near Bootooloo, 6 miles by rail south of Bowen, limestone is reported, but no examination of the occurrence has been made. At Mookarra, 11 miles by rail south of Bowen, powdery limestone has been worked, recorded production in 1952–3 being 900 tons. This also has not been inspected. It is probably similar in mode of occurrence to that near Inkerman (Home Hill). A sample analysed—

	Per cent.
Loss on ignition	41.5
Siliceous insolubles	3.3
CaO	48.0
MgO	3.5

No. 4 Deposit, Calcium.

13. Townsville District.

(A) Reid River.

Important reserves of limestone occur within a few miles of the railway to the north of Reid River, within 30–35 rail miles south of Townsville. The best deposits occur in the hills to the west of Calcium and Manton Sidings, but there are others on the eastern side of the line.

The limestone occurs as a number of lenses from about 20 ft. to over 200 ft. thick scattered over an area of 32 sq. miles, some of which is rough country. These lenses are apparently interbedded with rhyolites and pyroclastics which occupy a large part of the area and which are intruded by granite. In places the limestone is overlain and/or underlain by impure banded chert and limestone. It is intruded everywhere by fine-grained dykes from a few feet to 100 ft. wide, which have no noticeable effect on the rock.

Much of the limestone is of good quality, but slightly siliceous. It is generally light blue to grey. In places it is altered locally to white marble or garnet rock.

Total reserves have not been assessed, but probably amount to many millions of tons. Drilling has recently been employed to estimate reserves on portion 62v.

Age: Coralline limestone of Middle Devonian age.

(*a*) To the west of the railway the main limestone lenses occur from 2 to 4 miles from Calcium and Manton sidings. The most readily accessible outcrops are in freehold portions 62v, 59v, and 89v, parish Wyoming, where over a length of more than 1 mile, three main lenses occur. In the central one, in portion 62v, limestone outcrops on SE. dip slopes of 25–30 deg. over a length of some 1,500 ft., the northern part of which has been quarried for many years, the face being now over 100 ft. high. A reticulation of dykes and sills will increase quarrying costs and possibly restrict quarrying limits in the central and southern parts of this lens. Boring here has proved a thickness of some 130 ft. of good quality limestone, and confirmed an earlier provisional estimate of quarryable reserves of over 3 million tons.

Futher reserves exist in the smaller lenses to north and south of this deposit, which are also intruded by dykes. The former has lately been drilled, but the latter has not been investigated. (See analysis 1).

(*b*) About one mile NW. of the quarry and across Double Barrel Creek, on portions 81v and 569, there is another group of limestone outcrops with variable SE. dips which have been mapped but not explored in detail. Two of these deposits cover an

Quarry—No. 1 Deposit, Calcium.

aggregate area of about 70 acres and are of relatively easy access. Reserves in them, subject to confirmation by testing, have been estimated at 29 to 34 million tons with no overburden, plus an additional 24 million tons under a maximum cover of 50 ft. A possible further 40 million tons is probably not economically available because of difficulty of access and depth of overburden.

(*c*) About 3 miles SE. of Philp's siding limestone occurs in a prominent range between portions 100 and 394, parish Magenta and on G.F. No. 934. A large tonnage of limestone is available here in several workable beds, either vertical or steeply-inclined, but mapping and sub-surface exploration is needed to define reserves. Parts of the deposit are on freehold land. (See Analysis 2).

(*d*) In the northern part of the same range beds of limestone up to 40 ft. wide occur over a width of 5–10 chains. A quarry was formely worked in portion 100 (Analysis 3). A large tonnage of limestone occurs on both sides of the gorge traversing these hills, but some of it is intruded by dykes and considerably altered, and it is not so conveniently situated. No testing has been done.

(*e*) Several smaller occurrences are known in the area, but because of inferior quality, siliceous banding, intrusions, inaccessibility or other reasons, their prospective value does not compare with those listed above.

(*f*) A deposit of earthy lime occurs over an area of some 10 acres on portion 17, parish Magenta, 3 miles by road east of Reid River railway station.

Beneath a thin soil cover, the limestone is soft and earthy but includes nodules of compacted limestone. This gives place at varying depths to a rather compact limestone that requires pulverizing before marketing. There are occasional boulders of decomposed volcanic rock which are easily removed in quarrying.

It is believed that the deposit was formed by the intersection of numerous thick veins of calcium carbonate resulting from extreme decomposition in situ of andesitic agglomerate. A thickness of at least 20 ft. has been exposed, but the full depth is not known. Over a leased area of 5 acres it has been estimated that there are available 14,000 tons per vertical foot.

The limestone is quarried for use on the cane fields. Guaranteed CaO content of the bagged product is 42 per cent. (i.e. $CaCO_3$ 75 per cent.), but it is claimed that average grade is considerably higher (see Analysis 4).

Reid River limestone has been used for lime-burning for the sugar industry (in mills and agriculturally) and as a source of lime for cyaniding at Charters Towers; but the area has lately assumed major importance as a source of raw material for cement manufacture at Townsville.

No. 4 Deposit, Calcium—Close up view, showing silicified cap.

—	Moist.	Loss on Ignition.	CaO.	Siliceous Insolubles.	Al_2O_3.	Fe_2O_3.	MgO.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1. Quarry portion 62v Wyoming Typical Analysis	41·1		52·5	3·0	1·7		1·1
2. Grazing Farm 934, Magenta. 30 feet width in E. fall	0·04	42·2	52·3	3·1	0·8	0·5	1·2
3. Portion 100 Magenta, 40 feet width	0·04	41·0	50·1	5·6	1·1	0·5	1·76
4. Earthy lime, Reid River, 4 feet face	1·3	37·4	46·0	12·5	1·9	0·2	0·7

(C) Home Hill.

Several small deposits of earthy limestone occur in this area, and are of value for local agricultural use. One of these lying 11 miles SW. of Inkerman and 15 miles by road from Home Hill, rests on, and impregnates, decomposed granite. The deposits are

easily recognized by a change to a darker coloured soil. It has been suggested that they were formed from mound springs or shallow lakes. Some of the deposits are worked.

Age: Quaternary.

14. Townsville Hinterland.

(B) Broken River.

Thick beds of coralline limestone outcrop along the Broken River above its junction with the Clarke and at intervals along the road from the Broken River to Pandanus Creek and beyond. They belong

Gorge in Devonian Limestone, Broken River.
—Photo. Frome-Broken Hill Co. Pty. Ltd.

to the Broken River Group which is considerably folded in this area. Large quantities of limestone are available, but because of its remoteness, no detailed surveys have been made.

Age: Devonian-Silurian.

(B) Fanning River (18 miles by road NW. of rail at Mingela).

On the river, to the north of Fanning River Station, a bed of coralline limestone outcrops, dipping to the SSE. at 20 deg. East of the river the outcrop forms a semi-circular band of low scrubby hills and returns to the river at the Old Station, 5 miles downstream.

From 1½ to 2 miles above the site of the homestead (in 1939) the limestone is reported to be 400 ft. thick, and to strike NNW. with dip of 10 deg. to the WSW. It is fairly pure, and grey to brown in colour.

Age: Middle Devonian.

(B) Burdekin River.

At Burdekin Downs, 20 miles by road NW. of rail at Macrossan, and for 6 miles up the Burdekin River, a mass of coralline limestone outcrops at intervals. At the mouth of a creek falling into the Burdekin between Arthur's Creek and Burdekin Downs, the limestone dips at 10 deg. in a direction west of north. Elsewhere dips are somewhat variable. The thickness of the limestone has been estimated at 450 ft. The limestone at Burdekin Downs is reported to be impure and brown-weathering, and overlying quartzite.

Other limestone outcrops are known on the Basalt River, near Hillgrove Station (30 miles north of Charters Towers).

Age: Middle Devonian.

(C) Ewan (90 miles by road west of Townsville).

Small lenses of limestone occur to the north and north-east of Ewan. They are mostly small and have been more or less altered by contact metamorphism to white saccharoidal varieties.

Age: Devonian-Silurian.

(C) Christmas Creek.

Two isolated pinnacles of limestone have been noted to the west of the Burdekin River, near Christmas Creek, some 25 miles south-west of Kangaroo Hills Station and 70 miles from Ingham. No easy access.

Age: Devonian-Silurian.

15. Cairns District.

(C) Mowbray River.

A lens of limestone interbedded with fine-grained phyllites striking N. 12 deg. W. and dipping westerly at 65 deg., occurs on the southern slope of a ridge overlooking the Mowbray River, 2 miles from its mouth and 10 miles in a direct line south-east of Mossman.

The limestone which is cream to white in colour is crystalline, and might more appropriately be called a marble. The lens is 5 chains long and has a maximum width of 35 ft. No other limestone outcrops are known in the vicinity. A quarry has been operated since 1939 to supply ground stone for local use on canefields. Reserves above the quarry floor were estimated in 1948 at 17,500 tons with prospective reserves of 35,000 tons to 100 ft. below that datum.

In places the stone carries thin black bands. Some of the banded stone has a pleasing appearance and should make a good ornamental stone.

A sample of the pulverised limestone analysed—

	Per cent.
Moisture	0.1
Loss on ignition	42.6
Silica	1.2
Iron oxide	0.4
Al_2O_3	0.7
CaO	54.9
MgO	0.4

Age: Lower Palaeozoic-Devonian?

(C) Mulgrave River.

Limestone occurs in portion 13v parish of Grafton, 6 miles direct (18 miles by road) south-west of the railway at Gordonvale, close to the Little Mulgrave River and within 1 mile to the Gordonvale-Yungaburra road.

The limestone is a superficial deposit lying on the lower levels of the old metamorphic rocks where adjacent to a gully. A quarry exposed a 12 ft. face of limestone, and the quarry floor was 20–25 ft. above the bed of the gully, where slaty schists are exposed. The limestone is probably nowhere more than 30 ft. thick, and averages much less.

It is largely an open-textured porous rock, of travertine type, light to dark grey. An average sample from the quarry face analysed—

	Per cent.
CaO ..	49.7 (= $CaCO_3$ 88.7 per cent.)
MgO ..	nil
SiO_2 ..	2.6

A little carbonate of iron and manganese present.

It is practically certain that it is not a large deposit. No estimate of reserves has been possible.

A small amount of quarrying has been done for lime for the canefields.

Age: Recent.

Several small isolated exposures of marble occur over a distance of some 200 ft. in a tributary gully at the head of the West Mulgrave River, in a "window" in basalt-covered country. The stone is fine grained and even textured and varies from nearly pure white to smoky grey. Specimens polished well. Prospecting is needed to determine the extent. Access is from Malanda, whence the road distance is 11½ miles.

(C) Mount Peter (5 miles south of Edmonton and 3 miles west of Gordonvale).

A lone lens of white crystalline non-fossiliferous limestone (which may be classed as marble) outcrops on a steep northern spur of Mount Peter at an elevation of 1,700 ft. It is interbedded with metamorphic rocks striking N.–S. The lens has a maximum exposed width of 11½ ft. and can be traced for 3 chains. To work it an aerial ropeway would be necessary.

A sample representing the full exposed width gave—

	Per cent.
Moisture at 120 deg. C. ..	0.1
Loss on ignition	41.8
Acid insolubles (SiO_2 2.5; iron oxide + alumina 0.9) ..	4.0
Iron oxide, alumina	0.8
CaO	53.0
MgO	0.3

Age: Lower Palaeozoic.

(C) Yalkula (5 miles south from Mount Molloy, and 55 miles by rail from Cairns).

A single, apparently isolated bluff of limestone occurs 3 miles east of Yalkula siding. It is reached by a track 5 miles long from Southedge siding. The limestone occupies the lower part of a low hill. It is completely surrounded by schist and the outcrop, composed largely of craggy blocks, measures 5 chains long by 2 to 3 chains wide. The attitude of the deposit is not apparent, but there is some suggestion that it dips to the south and that the outcrop represents its full lateral extent. A tentative estimate shows reserves of the order of 100,000 tons. The limestone appears to be of high grade. One analysis showed—

	Per cent.
Loss on ignition	43.2
SiO_2	0.4
Fe_2O_3	0.07
Al_2O_3	0.07
CaO	54.9
MgO	0.3
P_2O_5	0.12

(C) Emerald Creek (5 miles east of Mareeba).

Small irregular lenses, up to a few feet thick, of marmorized limestone occur over an area of about 500 ft. in diameter. The largest outcrop covers 60 ft. by 40 ft. Most of them are too small for quarrying, and available stone is rather impure because of interbanding with the enclosing schist.

16. Cairns Hinterland.

(A) Chillagoe.

Very large quantities of high-grade limestone occur in the Chillagoe district.

Beds of coralline limestone, sometimes very thick, occur inter-bedded with steeply dipping quartzites and slates in a belt running NNW. from Almaden through Chillagoe and Mungana, to the Walsh River, a distance of 35 miles. To the north of this, sandstone mesas cover the belt, but it reappears at O.K. and Wrotham Park, and continues, with greater width, towards the Palmer. South-east from Mungana the belt is from 1 to 4 miles wide, and on its eastern margin is within close distance of the railway line. The most southerly extension is worked at Ootann, on the railway.

The limestone forms pinnacled masses which rise to 100–400 ft. above the intervening flat country. The limestone is generally semi-crystalline to crystalline, grey to black in colour, and at times passes into white marble and to garnet rock. Many caverns often of considerable size, occur within the limestones of the Chillagoe district.

Limestone has been quarried at Chillagoe for use as flux in smelting, and at Ootann, on the Etheridge railway, 8 miles south of Almaden, for lime-burning.

Age: Devonian-Silurian.

(B) Palmerville.

The limestone-bearing belt of the Chillagoe-Mungana district extends north-westwards and continues to the Palmer River near Palmerville. About 8 miles to the north of the Palmer the limestone belt passes under Mesozoic sandstones. The belt, which contains limestones interbedded with quartzites, schists and andesitic rocks, has a width of from 6 to 10 miles for some 25 miles southerly from Palmerville.

Age: Devonian-Silurian.

(B) Mount Garnet.

Limestones occur to the south of Koorboora and about Mount Garnet. They are frequently siliceous.

(C) Greenvale. (About 85 miles by road ESE. of Einasleigh).

Large lenses of massive slightly coralline limestones, interbedded with slates, cherts and other sediments, form pinnacle-like outcrops some 15 miles west of Greenvale Homestead.

Age: Devonian-Silurian ?

17. North-West Queensland.

(B) Cloncurry District.

Limestones (including dolomitic limestones) are of frequent occurrence in the Corella Formation of Lower Proterozoic age. This formation occurs in the eastern and southern portions of the Cloncurry Mineral Field. The Corella Formation consists of metamorphosed impure limestone and dolomite with interbedded quartzites, amphibolite and calcerous breccias. Lenses of recrystallised calcite have been worked for use as flux in copper and lead smelting. Individual lenses of calcite are relatively small in size and the production from many of these is restricted by the presence of calc-silicate minerals such as diopside and actinolite. Altogether over 500,000 tons of limestone flux have been produced, most of which has been used at the Mount Isa smelters.

The chief occurrences are as follows:—

(1) *Dolomite,* 6 miles by rail SW. of Cloncurry. A number of dolomitic limestone lenses occurs adjacent to and west of Dolomite siding and these have been quarried for the production of flux. In some cases a small but significant amount of copper occurs in the limestone.

Total production including the *Salmon, Dingo, Dolomite* and *Wilgar Quarries* is nearly 275,000 tons.

(2) *Juenburra,* 4 miles south of Duchess and 72 miles by rail SW. of Cloncurry. Lenses of pink coarsely crystalline calcite occur in amphibolite. One lens 170 yd. long with maximum width on the surface of 30 ft. has been exploited for smelter flux. The long axis of the lens is concordant with the strike of the enclosing rocks. The calcite occasionally carries copper and molybdenite.

(3) *Marimo,* 10 miles by rail south of Cloncurry. Lenses of calcite occur in amphibolite and calc-silicate rocks. Some copper minerals occur disseminated through the calcite (total production 51,000 tons).

(4) *First Hope,* 2 miles ENE. of Cloncurry. A similar occurrence in the Corella Formation. (10,700 tons produced in 1953).

(5) *Robin,* 20 miles east of Mount Isa near the Cloncurry-Mount Isa road. A single lens of high-grade crystalline calcite occurs.

(6) *Cameron,* 10 miles NNE. of the *Mary Kathleen* mine. A similar occurrence to others—but somewhat impure.

(7) *Kuta,* 6 miles ESE. of Mary Kathleen near the Corella River. A number of small lenses occur in calc-silicate granulite rocks.

(8) *Kajabbi-Dobbyn area,* 70-80 miles north of Cloncurry. Several isolated lenses of calcite occur. One is near the *Mighty Atom* mine, another is at the old *Digby Denham* mine and others at Elsie and Oona sidings (4,875 tons recorded 1950–53 but no record of production for Mount Cuthbert smelter).

(9) *Quamby,* 30 miles by road north of Cloncurry. A small lens of calcite has been quarried at the *Quamby Queen,* 2 miles NNE. of Quamby. Impure limestone deposits form large outcrops 10 miles west of Quamby, suitable for quarrying.

(10) *Myubee* siding, 77 miles by rail S.W. of Cloncurry. A small lens of calcite has been quarried near this siding.

(11) *Jersey Plains,* 15 miles NW. of Cloncurry. There are indications of a calcite deposit but no testing to prove its extent has been carried out.

Other outcrops of limestone have been noted at Mount Oxide, Gunpowder Creek, Dugald River, Mount Eurie (near the head of the Dugald) and Pumpkin Gully to the north of Cloncurry, at Ballara to the west, and at Hampden (average 3 ft. thickness) and Mount Elliott to the south.

None of the sedimentary limestones, which occur principally in the Corella Formation, are of sufficient size for commercial utilization.

(B) Lawn Hill.

Large quantities of limestone occur in the area about Lawn Hill.

Impure limestones and dolomites of Proterozoic age, largely pink and purplish, occur interbedded with shales and sandstones in the Ploughed Mountain beds which crop out typically 6 to 9 miles ENE. from Lawn Hill Homestead.

Crystalline grey and white limestone of Cambrian age, occurs about Lawn Hill Homestead, and over a large area some 16 miles by 8 miles on the Dentalium Plateau to the SSE. of the Homestead.

These limestones extend to the SW. and SSW. of the Homestead to the Barkly Tableland. In Louie Creek Canyon, on the eastern side of the Constance Range, a thickness of several hundred feet of thin-bedded limestone is exposed, unconformably overlying Proterozoic sandstones. The limestones are flatly dipping and have been subjected to only mild earth movements and no metamorphism.

At Riversleigh, some 22 miles SE. of Lawn Hill, is a large limestone mountain, the Tarpeian Rock, containing Tertiary fossils, and several outcrops of Tertiary limestone occur along the Gregory River Valley.

(B) Barkly Tableland.

Limestones occur over a very large area embracing the plains of the Barkly Tableland, between 700 and 800 ft. above sea-level and dissected regions to

Cambrian Limestone, Riversleigh, N.W. Queensland. Weathering of former limestone caves.
—*Photo. F. W. Whitehouse.*

the NE. and SE. of these plains, and for a considerable distance south of the Tableland.

The area within which limestones occur trends north-south, with widths varying from 30 to 100 miles on the Queensland side of the Border, but extends over a large area into the Northern Territory. The region, centred about the Georgina River, extends from north of the Gregory River, through Camooweal and Urandangie to Glenormiston in the south, with an easterly extension through Chatsworth to Devoncourt.

The dissected limestone areas to the NE. and SE. of the Barkly Tableland proper are separated by a large tongue of lateritic soils, extending westwards from Yelvertoft almost to Camooweal.

The limestone series, which is of Cambrian age and virtually horizontal, consists of brown, grey, white, and blue crystalline limestones sometimes impure, with interbedded cherts and shales. The series has a great thickness, a bore on Alexandria Downs in the Northern Territory reaching 1,700 ft. without passing out of limestones.

Outcrops are relatively scarce on the Barkly Tableland proper because of a deep soil cover. In many places the Cambrian rocks are covered by a mantle of later deposits, which include Tertiary limestones (often silicified), usually difficult to distinguish from the Cambrian limestones.

(C) Paradise Valley (30 miles north of Yelvertoft, at the head of Paradise Creek, which is a tributary of Gunpowder Creek).

Interbedded with shales and quartzites of the Paradise Creek Beds (equivalent to the Ploughed Mountain Beds), limestones occur to the SE. of Paradise Valley towards Mount Kelly. Along Paradise Creek thin-bedded impure limestones, much contorted, are abundant. Elsewhere the beds are usually not highly folded. At a point 10 miles S.E. of Paradise Valley possibly algal limestones occur.

Age: Proterozoic.

(C) Westmoreland.

The Wollogorang Formation which extends from the Northern Territory into Queensland north of the Nicholson River consists of limestone (dolomitic) interbedded with quartz siltstone. The formation is of Proterozoic age and dips gently to the south. The limestones are usually impure and are silicified in part.

(C) Glenormiston (Lower Georgina Basin).

The Cambrian limestones of the Barkly Tableland extend southwards through the Georgina Basin, to Glenormiston. To the south-west of Glenormiston they are overlain by younger sandstones of the Toko Range, and to the south and east Cretaceous sediments occur. The limestones are almost horizontal.

Along Pituri Creek (a tributary of the Georgina River) on which Glenormiston Homestead is built, siliceous limestones of tertiary age occur, their depth at the Homestead being about 30 ft.

18. Great Barrier Reef.

(A) Great Barrier Reef.

Very large quantities of calcium carbonate are available in the coral sand and reefs of the Great Barrier Reef.

A pre-requisite would be the location and sampling of deposits suitable for dredging.

It is reported that coral sand was obtained some years ago from Oyster Cay, 20 miles from Cairns. The Cay has an area of several acres. There are other coral reefs in the vicinity.

A bore on Heron Island, 50 miles NE. of Gladstone in 1937, revealed 17 ft. of coral sand with about 91 per cent. $CaCO_3$, 5 per cent. $MgCO_3$ and 1 per cent. insolubles over coral reef rock which to a depth of 289 ft. averaged about 95 per cent. $CaCO_3$, 1·5 per cent. $MgCO_3$ and 2 per cent. insolubles.

Another bore on Michaelmas Cay, 23 miles NNE. of Cairns, in 1926, passed through coralline material (alternating sand and reef rock) which to a depth of 378 ft. averaged over 90 per cent. $CaCO_3$, less than 1 per cent. $MgCO_3$ and about 5 per cent. insolubles.

19. Miscellaneous Minor Deposits.

(B) Doongmabulla (about 100 miles NW. of Clermont, on a tributary of the Belyando River).

Limestones occur at Doongmabulla Homestead on the slopes abutting on the eastern side of Dooyne Creek, forming a step-like zone about ¼ mile wide and about 30 ft. above creek level.

The limestone is concretionary, and the lower part is somewhat chalk-like.

Age: Late Tertiary?

(C) Corinda (Woolshed) (50 miles west of Doongmabulla).

Nodular limestones outcrop through the soil over an area some 2 miles wide and 6 miles long, on the gentle eastern slopes of the valley of Thunderbolt Creek.

Age: Late Tertiary?

(C) Warenda (25 miles NE. of Boulia).

Areas of Cambrian limestone occur on Warenda holding, as inliers in the younger sedimentary rocks, forming the elevated masses of Black Mountain, Ninmaroo, and Mount Datson. There are also several smaller areas of siliceous limestones of Tertiary age.

20. Dolomite and Magnesian Limestone.

(A) Flinders (14 miles by rail south from Ipswich).

Magnesian limestone, of rather variable grade, occurs within an area of about 5 sq. miles extending for about 3½ miles south from Flinders railway station. The magnesian limestone occurs within an area of basalt and forms a series of ridges. It varies in form from white compact and nodular to friable and clay-like, and is sometimes very siliceous and in places carries concretionary flint. Large quantities are probably available, but systematic testing is needed to determine reserves and quality. On portion 99, 2½ miles south of the railway station, quarrying has revealed widths up to 45 ft. and depths of at least 15 ft. under a cover of 6 in. to 12 in. of soil.

The following are available analyses:—

—	Moisture.	Loss on Ignition.	SiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	MgO.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Portions 11, 7–¾ m. S. of Flinders	2·1	41·7	8·6	2·6		24·3	20·7
Portion 17–¾ m. S. of Flinders	1·2	38·8	14·8	1·3	1·3	24·0	18·4
Portion 188A–2 m. S. of Flinders	0·4	46·3	0·8	1·6		30·4	20·5
Portion 188A–2 m. S. of Flinders	3·1	40·8	9·6	1·2		28·4	16·9
Portion 189–2 m. S.S.E. of Flinders	3·4	40·3	7·9	4·2		26·2	18·0
Portion 99–2½ m. S. of Flinders	1·6	43·1	5·9	2·6		25·9	20·9
Portion 100–2½ m. S. by E. of Flinders ..	0·4	42·5	6·5	0·9	4·5	28·4	16·7
Portion 100–2½ m. S. by E. of Flinders ..	0·8	40·0	11·7	1·2	3·8	26·1	16·1
Portion 102–3 m. S. of Flinders	0·2	43·9	4·2	0·8	2·1	28·6	19·9
Portion 102–3 m. S. of Flinders	0·9	46·3	0·4	1·7		29·5	21·2

Magnesian limestone has been quarried at Flinders for a number of years and marketed as "dolomite" for agricultural use.

(B) Mount Isa.

Large masses of "dolomite" occur in the hanging-wall country of the silver-lead-zinc lodes. The "dolomite" filled fractures in silicified shale and replaced it to varying degrees. The "dolomite" bodies are elongated north-south and dip west at 70–75 deg. which is somewhat steeper than the enclosing shales.

The massive "dolomite" is a medium- to coarse-grained mixture of carbonates estimated to contain 60 per cent. dolomite, 30 per cent. ankerite and a small amount of manganiferous siderite. The "dolomite" is insignificant in outcrop but increases in size with depth. In the "Black Star" section at a depth of 1,400 ft. the "dolomite" is 1,600 ft. long and at least 300 ft. wide. It is the host of the "Black Star" copper ore-body. Other bodies of "dolomite" also occur but are as yet incompletely delimited. The "dolomite" forming the gangue of the copper ore mined provides carbonate flux in smelting operations. The occurrences are on Mount Isa Mines Ltd's. leases.

(C) Great Australia, Cloncurry.

A non-outcropping body of "dolomite" containing pyrite and chalcopyrite was partly developed during early mining operations. On the 300-ft. level it was 500 ft. long and 50 ft. wide. It occurs adjacent to the shears which contained the main copper mineralisation.

(C) Clermont.

In the black soil around Clermont, small ridges of nodular magnesian limestone are found in several places. It occurs in some abundance on Langdon Downs, east of Clermont, where it has been quarried for ballast. A sample of Langdon limestone analysed—

	Per cent.
SiO_2 (free)	2.2
SiO_2 (combined)	2.9
Fe_2O_3 and Al_2O_3	4.5
$CaCO_3$	52.7
$MgCO_3$	38.5

(C) Ipswich.

Magnesian limestone, generally more or less siliceous, outcrops on Limestone Hill in the city, and for some distance eastwards. It is mostly reserve or improved land.

Magnesian limestone has also been quarried to a small extent on portion 225, parish Ipswich (near Raceview), where lumps have been exposed in the black soil over an area of 2 acres. Occasional outcrops are seen for nearly ½ mile south-westwards on improved land.

The limestone in Queen's Park was burnt for lime in the early days, and outcropping limestone from various localities was also used in the manufacture of cement.

Age: Tertiary.

(C) Redbank Plains (3 miles by road south of Redbank).

Impure magnesian limestone has been worked over an area of 350 ft. by 100 ft. and to a depth of 7–8 ft. on portion 38, parish Goodna. It occurs beneath a shallow cover of black soil, and appears to overlie decomposed basalt. Several other small outcrops occur to the east and south of this and occasionally lumps are found in the black soil over an area of 1½ square miles. The limestone occurs as lenticular beds, whose extent cannot be predicted on surface evidence.

The quality is rather variable. Analyses of two face samples are as follows:—

—	1. (Greenish).	2. (White).
	Per cent.	Per cent.
Loss on Ignition	30·9	37·3
Sio_2	27·7	15·0
Fe_2O_3	9·2	2·1
Al_2O_3	7·4	3·3
CaO	14·0	27·2
MgO	10·1	14·7

Age: Tertiary.

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TABLE OF MOST IMPORTANT LIMESTONE DEPOSITS IN QUEENSLAND.

Map Ref.	Location.	Nature.	Extent.	Reserves.	Quality and Analysis.	Remarks.
1	GORE, 45 miles by rail west of Warwick	Large lenticular masses interbedded with nearly vertical slates. Cavernous in part	Belt extending for at least 6 miles S.S.E. from near Gore. Main workings are about 4 miles south of Gore	Large. No estimates made	High grade. One sample— CaO .. 55·9% MgO ..nil SiO_2 .. 0·4% R_2O_3 .. 0·2%	Quarried for many years for lime-burning. Formerly supplied raw material to Darra Cement Works.
2	LIMEVALE, 10 miles north of Texas, and 2–3 miles from railway	Fine grained marble, variously coloured, mostly grey to white	Not known ..	Believed large ..	Fairly pure ..	Quarried for building, monumental and terazzo work.
6	MORETON BAY, at mouth of Brisbane River	Reef coral debris fringing several islands, partly exposed at low tide	At Mud Island thickness 25 ft. resting on mud. Other islands not investigated	Large. Deposit at Mud Island has been test-bored	Range 70–92% $CaCO_3$ Typical Analysis— CaO .. 48·07% MgO .. 1·17% SiO_2 .. 6·57% R_2O_3 .. 2·92%	Dredged at Mud Island for use at Darra Cement Works.
9	TAMAREE, 5 miles north of Gympie, adjoining railway	Lenticular masses interbedded with shallow-dipping altered shales and sandstones	Intermittent outcrops over 200 acres	Large. No estimates.	Variably siliceous. Sample from 50 ft. working face— CaO .. 45·5% MgO .. 0·4% SiO_2 .. 13·5% R_2O_3 .. 2·6%	Readily available reserves of better stone depleted. Overburden a handicap.
10	CURRA, 4 miles from railway at Curra, which is 8 miles north of Gympie	Large bed ..	Said to be 50 ft. thick. Extent not known	Believed moderately large	One sample— CaO .. 51·0% MgO .. 0·2% SiO_2 .. 5·1% R_2O_3 .. 1·6%	Once quarried for lime making, but abandoned for many years. Recently re-opened.
15	BIGGENDEN–DEGILBO, 54 miles by rail west from Maryborough	Lenses interbedded with slates, steeply dipping	From 4–5 miles S.W. of Biggenden to north of railway	Large	Much of stone sufficiently pure for lime-making, but some impure	Formerly quarried one mile east of Degilbo.
19	PHILPOTT CREEK, adjacent railway, 4 miles east of Mundubbera, 109 miles from Maryborough	Large mass of coralline limestone	Outcrops known over at least 20 acres; may be much more extensive	Believed large. No testing	Average outcrop sample— CaO .. 53·7% MgO .. 0·6% SiO_2 .. 1·4% R_2O_3 .. 1·0%	Undeveloped. Would require investigation.
22	DALYSFORD, Within 5 miles of rail at Dalysford, 36 miles west from Bundaberg	Deposits associated with slates and schistose rocks	Several comparatively small deposits, up to 5 chains long by 1 chain wide	Considerable in toto, but small in any one deposit	One sample— CaO .. 46·9 MgO .. trace SiO_2 .. 5·1% R_2O_3 .. 3·4%	Main importance lies in relatively easy access from Bundaberg.
25	AMBROSE, ¼ mile from railway, 27 miles north of Gladstone	Large vertical bed of coralline limestone outcropping over gently undulating area	Outcrops over 8 acres, probably extends over considerably greater area	Probably many million tons available. No testing	One sample— CaO .. 55·1% MgO .. 0·1% SiO_2 .. 1·0% R_2O_3 .. 1·2%	Quarried for many years for lime-burning and lately for smelter flux.
26	CALLIOPE, within 3 miles of railway between Calliope and Barmundoo, 16–25 miles south from Gladstone	Lenses associated with slates, etc., steeply dipping	Greatest development over 3 mile length to east of Barmundoo, but other deposits to north and south	Large in aggregate but limited in individual deposits	Unknown ..	Undeveloped.
36	RAGLAN, 5 miles from rail, 34 miles south of Rockhampton	Lenticular bodies	Belt at least 20 chains wide, probably several miles long	Large. No testing done	Range of 3 samples CaO 53·3–54·5%	Has been quarried for agricultural and sugar refinery use.
35	MARMOR, 26 miles by rail south of Rockhampton	Lenses of crinoidal limestone	Extent no known	Believed large. No testing	No analyses available	Quarried extensively for smelting and agriculture.
39	ULAM, 15 miles south of rail at Bajool, 21 miles south from Rockhampton	Vertical beds of crystalline limestone, with metamorphics, partly destroyed by dykes	Main bed estimated 1,000 ft. thick	Many millions of tons of marble	Average sample— CaO .. 55·3% MgO .. 0·4% SiO_2 .. 0·2% R_2O_3 .. 0·2%	Quarried for marble for building and monumental uses.

TABLE OF MOST IMPORTANT LIMESTONE DEPOSITS IN QUEENSLAND—continued.

Map Ref.	Location.	Nature.	Extent.	Reserves.	Quality and Analysis.	Remarks.
37	GLENMORE, 3 miles by rail north of Rockhampton and adjoining Fitzroy River	Lenticular masses of fossiliferous limestone	Two main lenses, the larger 1½ miles long × 27 chains maximum width	Believed very large	$CaCO_3$ 95–96%	Once quarried, but not worked now.
34	MOUNT ETNA—THE CAVES, 15 miles by rail north of Rockhampton	Masses of coralline limestone interbedded with slates and volcanics	Immense bodies, up to one mile by ½ mile in extent	Many millions of tons assured	Range of samples from quarry— % CaO ..54·4–55·0 MgO 0·03–0·09 SiO_2 0·50–1·35 R_2O_3 0·37–0·66	Quarried for many years for agriculture and smelting.
38	DUKE ISLANDS, east of St. Lawrence, 15 miles from Stannage Point—					
	(*a*) Mortar Island ..	Island mostly marble	10 acres, up to 120 ft. high	Estimated above H.W.M. 660,000 tons	Average sample— CaO .. 55·1% MgO .. 0·0% SiO_2 .. 0·9% R_2O_3 .. 0·5%	Quarried in past.
	(*b*) Marble Island ..	One area of importance—Marble	1¼ acres, maximum height 50 ft.	Estimated above H.W.M. 120,000 tons	Sample— CaO .. 54·4% MgO .. 0·0% SiO_2 .. 1·8% R_2O_3 .. 0·8%	
	(*c*) Hunter Island ..	Lenses of marble interbedded with slates	Four main areas, largest a steep-dipping bed 400 ft. thick	Estimated above H.W.M. 2,330,000 tons	Range of 4 samples— % CaO 51·9–55·0 MgO 0·0–0·6 SiO_2 1·0–4·6 R_2O_3 0·8–1·6	
55	REID RIVER, 2 to 5 miles from rail at Calcium, 30 miles south of Townsville	Lenses of coralline limestone, intruded by dykes and sills	Several isolated lenses, largest 1,500 ft. long and maximum thickness over 200 ft., lower portion siliceous	Large in aggregate. Working lens test-bored, few million tons. Larger deposits further west.	Range of 3 analyses % CaO 50·1–52·5 MgO 1·1–1·76 SiO_2 3·0–5·6 R_2O_3 1·3–1·7	Only one deposit quarried. First worked for agricultural lime, but now of major importance for cement manufacture at Townsville.
66	CHILLAGOE, 139 miles by rail west from Cairns	Large masses of cavernous coralline limestone interbedded with quartzite and shale, steep-dipping. Limestone forms pinnacles and rugged ridges up to 400 ft. high	Belt 1 to 4 miles wide extending from Muldiva through Chillagoe and Mungana to Walsh River	Very large ..	High quality ..	Has been quarried for flux for smelting at Chillagoe, also for agricultural lime at Ootann and Mungana.
70	CLONCURRY DISTRICT	Relatively small lenses of coarsely crystalline calcite, interbedded with quartzite and amphibolite	Widely scattered in Corella Formation between Duchess and Dobbyn	Probably large in aggregate, but small in any one deposit	Good quality; Some deposits dolomitic. Some contain small amount of copper	Worked extensively for flux in copper and lead smelting.
76	GREAT BARRIER REEF	Reef coral and coral sand	Off coast northwards from Tropic of Capricorn	Very great ..	Bore sections on Heron Island and Michaelmas Cay averaged about 90% $CaCO_3$, with 5% $MgCO_3$ in the former	Believed a major potential source. Would require investigation to locate areas suitable for dredging.
80	FLINDERS, 14 miles by rail south of Ipswich	Masses of magnesian limestone forming ridges in basalt country	Intermittent deposits within an area of 5 square miles	Probably large. No estimates	Rather variable. Range of 10 analyses— % CaO 24·0–30·4 MgO 16·1–21·2 SiO_2 0·4–14·8 R_2O_3 1·2–5·0	Quarried and marketed as "dolomite" for agriculture.

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QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 12. NEW WHITWOOD MINE AREA, DINMORE

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PART 13. COONEANA ESTATE MINE AREA

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PART 12—NEW WHITWOOD MINE AREA, DINMORE

SUMMARY

—o—

Drilling layout recommended by Powell Duffryn Technical Services Ltd. for the northern part of Nos. 12 and 14 Mine Areas was modified so as to prove reserves of coal accessible from the existing workings of Whitwood No. 3 Shaft and New Whitwood No. 2 Tunnel.

Six boreholes (including one redrill) tested the area to a maximum depth of 969 ft., aggregate footage drilled being 3,850 ft.

This report, accompanied by six figures, describes the geology of the area and the seam succession in some detail, records the results of drilling and assesses coal reserves available for exploitation.

Detailed geological mapping was carried out in the western part of the area where overthrusting has produced an arcuate zone of overturned and steeply dipping strata limiting mine development in that direction. To the east of this, regional folding results in a change in strike from N.–S. in the south-western corner to E.–W. in the northern and eastern sections. The main part of the area is bounded on all sides by major faulting and is divided into two sections by a N.E.–S.W. fault.

The coal is classified as high volatile bituminous, average fixed carbon content being 65.28 per cent.

Reserves have been calculated for the Striped Bacon and Rob Roy Seams in the areas accessible from the two working mines. Total reserves accessible from Whitwood No. 3 Shaft amount to 940,000 tons in the Striped Bacon Seam and 870,000 tons in the Rob Roy while from New Whitwood No. 2 Tunnel corresponding figures are 350,000 tons and 320,000 tons.

Beneficiation by washing at sp. gr. 1.8 would reduce combined figures to 870,000 tons in the Striped Bacon Seam and 890,000 tons in the Rob Roy.

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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD
PART 12—NEW WHITWOOD MINE AREA, DINMORE

Introduction

A series of five boreholes was drilled in New Whitwood Colliery Pty. Ltd. leases as part of the Mines Department drilling programme on the Ipswich Coalfield. The drilling recommended by Powell Duffryn Technical Services Ltd. for the northern half of Nos. 12 and 14 Mine Areas was modified so as to prove reserves of coal which could be reached from existing mine workings viz.—Whitwood No. 3 Shaft and New Whitwood No. 2 Tunnel.

In addition to the five boreholes, numbered N.S. 134–138 inclusive, which were drilled in the area during the period 2nd March–11th May, 1956, borehole N.S. 145 drilled as part of the Rhondda programme can be more suitably included in a discussion on the Whitwood leases since it lies within their limits. The drilling of this borehole commenced on 18th July, 1956, and was completed some five weeks later.

The shallowest borehole was N.S. 134, abandoned at 189 ft. 4 in. because of serious core loss due to faulting, and replaced by N.S. 136. The deepest hole was N.S. 145 which reached a depth of 969 ft. The total footage drilled in the six boreholes amounted to 3,850 ft.

The area covered by the drilling campaign is located immediately to the south-east of New Chum village which lies some ¾ mile south of the railway at Dinmore.

The detailed field mapping necessary for the preparation of the geological map accompanying this report was carried out by J. H. Hill, B.Sc. (Hons.) and D. C. Mengel, B.Sc.

The following plans and sections accompany this report:—

Fig. 1.—Plan showing bore sites, topography, surface geology and a locality plan.

Fig. 2.—Plan showing bore sites, underground workings and approximate area in which reserves have been calculated.

Fig. 3.—Generalised bore sections.

Figs. 4–6.—Detailed sections of seams from boreholes and from mine workings showing core recoveries and analytical data.

Cross sections and seam contour plans have not been prepared because level data available are insufficient to provide adequate control in this folded and severely faulted area.

Geology

Tertiary

Tertiary strata have been mapped in a tongue-shaped belt reaching almost to Whitwood No. 3 Shaft from the south-east. The beds consist mainly of soft greenish-black, red or creamy mudstone with some friable, partly ferruginised sandstone. These rocks form a thin veneer on beds of the Bundamba sandstone, which in places protrude through the Tertiary sediments.

Some igneous rocks have been found associated with the Tertiary beds but it has not been determined whether they are intrusions or remnants of basic flows.

The base of the Tertiary is considered to be at 75 ft. in N.S. 138 and at 181 ft. 9 in. in N.S. 145, but was not recognised in any other borehole. N.S. 135 and N.S. 137 encountered Bundamba sandstone as soon as coring commenced, and although no firm conclusion was reached regarding the first 75 ft. of strata in N.S. 134 it is not at present regarded as of Tertiary age.

Bundamba Sandstone and Aberdare Conglomerate

Some outcrops of coarse pebbly sandstone with isolated fine conglomerate lenses at the base have been mapped overlying the Bluff Seam in the northern section of the mine area. The conglomerate partly erodes the Bluff Seam in a cutting N.E. of Whitwood No. 3 Shaft, but in boreholes this sandstone horizon is about 50 ft. above the Bluff Seam. It is reasonable to assume that this fine conglomerate is equivalent to the Aberdare Conglomerate and that the overlying sandstone and siltstone beds are representative of the basal section of the Bundamba Sandstone.

Ipswich Coal Measures

Blackstone "Stage"

The Blackstone "Stage" varies in thickness from 420 ft. to 500 ft. Five coal seams were penetrated in the boreholes which intersected the full succession in the "stage."

The major variation from the normal shale, siltstone and fine sandstone lithology of the Blackstone "Stage" is the occurrence of a thick sandstone bed between the Four Feet and Bergin Seams. This sandstone is very coarse at the base but is fine grained in the upper layers. In the coarse section the matrix is extremely argillaceous but it is much harder and in part siliceous in the finer grained types. It is best exposed to the west of New Whitwood No. 2 Tunnel, and was also penetrated in Whitwood No. 3 Shaft where 80 ft. of sandstone was reported.

In the boreholes, N.S. 138 penetrated a 50 ft. thick sandstone bed but to the north and east shale is the commonest rock type separating the Four Feet and Bergin Seam horizons.

Outcrops of the Four Feet, Bergin, Striped Bacon, and Rob Roy Seams have been located in and traced through the zone of steeply dipping strata which forms such a dominant feature of the western part of the area. The Bluff Seam has been located in the northern section and again ahead of New Whitwood No. 1 Tunnel.

Cooneana "Stage"

Four boreholes penetrated the upper section of the Cooneana "Stage" and in general showed a shale bed 10 ft. to 20 ft. thick underlying the Rob Roy Seam, with 50 ft. of medium to coarse grained sandstone below the shale. This overlies a shale-siltstone sequence which in some bores includes a thin inferior coaly section.

At the surface, widespread outcrops of coarse pebbly sandstone are to be seen to the west of Whitwood No. 3 Shaft and No. 2 Tunnel.

Coal Seams

Five coal seams were located in the Blackstone "Stage" while a sixth coaly horizon was located in some boreholes near the top of the Cooneana "Stage." The named coal seams in descending order are:—

Bluff Seam.
Four Feet Seam (Top Coal and main seam).
Bergin Seam.
Striped Bacon Seam.
Rob Roy Seam.

Bluff Seam

The Bluff Seam appears to have developed into a workable coal seam in a small basin in the vicinity of N.S. 135 and N.S. 138. It reached a maximum thickness of 19 ft. in N.S. 135, in which the seam was repeated by a reverse fault with a throw of 80 ft. A 9 in. band of light grey shale at 161 ft. is suggestive of the Bluff "marker" band. No analysis was carried out on any Bluff Seam section but this borehole shows what is undoubtedly a workable section, especially between 161 ft. 9 in. and 171 ft. 4 in., in a thickness of 9 ft. 7 in. which included only 7½ in. shale. This seam section is far superior to that encountered in any other borehole.

The next best section was in N.S. 138, where the seam was 18 ft. thick. The 9 in. thick light grey shale band was located 3 ft. 9 in. from the top, but the section of coal under this band was extremely banded and on visual inspection did not appear to be workable.

In N.S. 145 the Bluff Seam was penetrated between 556 ft. 3 in. and 567 ft. 4 in. but the characteristic light grey shale band was not recognised. The section, consisting largely of carbonaceous shale and coal bands, was not workable.

East of N.S. 135 the Bluff Seam was not definitely recognised although a coaly horizon at 300 ft. in N.S. 137 has been tentatively correlated with it.

Near the outcrop of the seam in the northern section of the area, diamond drillholes Nos. 3 and 5 put down by New Whitwood Colliery Pty. Ltd. penetrated the Bluff Seam at depths of 135 ft. and 70 ft. respectively. In each case the seam was represented by a thin coaly shale horizon. The Bluff Seam was not located in N.S. 134/136 or in the adjacent No. 2 company bore, but since the upper sections of N.S. 134/136 penetrated extremely broken ground the seam may have been faulted out in those particular holes.

The seam outcrop has been located in a creek bed 5½ chains N.W. of N.S. 136 and it shows again under the coal chute at the haulage cutting between Whitwood No. 3 Shaft and the rail siding at New Chum No. 4 Tunnel.

The seam can be seen again in a creek 14½ chains E.N.E. of New Whitwood No. 2 Tunnel.

Four Feet Seam

This seam, together with the Four Feet Top Coal, has been worked over much of the New Whitwood Colliery leases. The main workings were from Whitwood No. 3 Shaft, Whitwood No. 4 Shaft (north of the shaft only), New Chum No. 4 Tunnel and New Whitwood No. 1 Tunnel. Workings from Noblevale No. 2 Colliery and Belmont No. 3 Tunnel extracted most of the available Four Feet coal in leases adjoining on the east.

Four of the five boreholes in the area penetrated a workable section in the Four Feet Seam, while in N.S. 137 it was absent due to faulting.

The overall thickness (Top Coal and main Four Feet Seam) averaged 20 ft., excluding N.S. 136 where a thickness of 45 ft. was penetrated. Since the seam was brecciated in this borehole the excess thickness is probably due to repetition by overthrusting in the Top Coal. The seam section in the adjacent New Whitwood Colliery No. 2 Bore is 21 ft. 6 in. thick which is close to average.

In the southern portion of the leases the seam section in New Whitwood No. 1 Tunnel as recorded by A. K. Denmead (1955, fig. 7) is comparable with the sections from N.S. 135, N.S. 138 and N.S. 145 (see Table A). In No. 1 Tunnel a "boulder" band 13 in. above the "double white marker" bands forms the roof of the measured section. This "boulder" band was found in this position in all three boreholes. The main Four Feet Seam (under the marker bands) showed a thickness of 3 ft. 4 in. in No. 1 Tunnel, 3 ft. 2 in. in N.S. 138, 3 ft. in N.S. 135 and 3 ft. 2 in. in N.S. 145. In only one case, viz. N.S. 135, was the main Four Feet Seam sampled separately and in this instance it carried 19.9 per cent. ash. In the case of N.S. 138, the section sampled included 1 ft. 10¾ in. of coal with shale bands underlying

the main seam, while in N.S. 145 the "marker" bands and "brushing band" section up to the "boulder" were sampled with the main Four Feet Seam. The ash content in N.S. 138 was 25.6 per cent., while in N.S. 145 it was 29.1 per cent. Of interest is the ash percentage from the main Four Feet Seam in New Whitwood No. 1 Tunnel where three samples taken by A. K. Denmead (1955, p. 42) carried an average ash content of 11.5 per cent.

Above the "boulder" band in each of the three southern boreholes there is from 12 ft. to 15 ft. of coal and shale bands, the upper portion of which has been mined in the area as the Four Feet Top Coal. In N.S. 138 the Top Coal was 6 ft. 8 in. thick and carried 24.6 per cent. ash, while in N.S. 135 a section 6 ft. 9 in. thick was sampled and found to carry 30.8 per cent. ash. There is further deterioration in the Top Coal in N.S. 145 where the top 4 ft. 5 in. of the seam carried 33.9 per cent. ash. The coal and shale bands lying between this upper section and the "boulder" band are unworkable, having an ash content in the vicinity of 50 per cent. in each borehole.

An area of Four Feet coal is delineated by boreholes N.S. 138, N.S. 135, and N.S. 145 but the disposition of lease boundaries and the location of faulting in the area must make difficult any attempt to extract this coal economically. The first known fault is a reverse fault encountered in N.S. 135, which possibly strikes north-south and which has a throw of 80 ft. N.S. 145 is affected by faulting throughout and a comparison of relative levels on the seams in this borehole with levels in bores to the south indicates a downthrow of possibly 300 to 400 ft. in this bore. It is assumed that this faulting is connected with the so-called Rhondda fault zone.

Bergin Seam

Although the Bergin Seam has been extensively worked from Whitwood No. 3 Shaft and New Whitwood No. 2 Tunnel, it was either not recognised or was represented by a very thin coaly horizon in all boreholes except N.S. 138 which is only 4½ chains to the south of the present dip face in New Whitwood No. 2 Tunnel. Bores N.S. 136, 135, 137, and N.S. 145, which lie on a more or less north-south line to the east of the Whitwood Bergin Seam workings, indicate rapid deterioration of the seam in that direction. Company diamond drill records of No. 3 bore also show a thin coaly shale horizon at the expected level of the Bergin Seam. This easterly deterioration gave rise to the suggestion (Hawkins, 1957) that it was the Striped Bacon Seam and not the Bergin Seam which was worked in Noblevale No. 2 Colliery and further east in New Aberdare East No. 3 Tunnel.

The Bergin Seam is separated from the Four Feet Seam by 80 ft., mainly of sandstone, in Whitwood No. 3 Shaft (Denmead, 1955, p. 91) but company officials report that in workings north of the shaft the two seams are separated by only 6 ft. of strata. A coarse argillaceous sandstone forms the roof of the seam in New Whitwood No. 2 Tunnel except at the dip face, but in the boreholes this massive sandstone lenses out and shows a maximum thickness of 40 ft. in N.S. 138.

The seam is from 13 ft. to 14 ft. thick with the "tops" separated from the "bottoms" by 1 ft. to 1 ft. 6 in. of shale. Some local variations in thickness of this shale band have been noticed in No. 2 Tunnel where it increases to a maximum thickness of 2 ft. 6 in. in the upper part of the mine. In other places it is only 4 in. thick. A coal ply often splits the shale band.

The seam section in N.S. 138 is very similar to that worked in No. 2 Tunnel, i.e. "tops" approximately 4 ft. 6 in. thick separated from the "bottoms" by 1 ft. 6 in. of shale. The bottom section as mined is 6 ft. 9 in. thick but a thickness of 9 ft. was sampled from N.S. 138. The seam can be expected to deteriorate fairly rapidly as the dip in No. 2 Tunnel is driven to the east-north-east.

Striped Bacon Seam

Throughout the Whitwood area this seam is separated from the overlying Bergin Seam by approximately 50 ft. of shale and siltstone.

The seam was extensively worked to the north of Whitwood No. 3 shaft, but only to a very limited extent to the south. The seam thickness in those workings was variable, a section 5 ft. 7 in. thick being worked to the east of the shaft, while to the south the thickness was only 4 ft. 3 in. In the boreholes the full seam thickness varied from 5 ft. 10 in. in N.S. 138 to 10 ft. 9 in. in N.S. 136, while the section sampled for analysis varied in thickness from 5 ft. 10 in. in N.S. 138 to 7 ft. 6 in. in N.S. 137. Analyses from these seam sections indicate a marked improvement in the quality of the coal in the south-east corner of the leases, but boreholes N.S. 136 and N.S. 138 showed seam sections carrying ash values in excess of 30 per cent. and beneficiation would be required to produce a marketable product.

The seam is characterised by a light grey or fawn shale band which is usually from 2 in. to 3 in. thick. In boreholes this band was from 3 ft. 10 in. (N.S. 138) to 4 ft. 8 in. (N.S. 135) from the top of the seam. A 1½ in. thick medium to dark grey shale band is often found some 9 in. above the fawn shale band. Most of the workings on the Sriped Bacon Seam have mined only to the fawn shale band but sampling from boreholes was carried on an average 2 ft. 6 in. below this band. This accounts for the high ash values in the seam sections from N.S. 136 and N.S. 138 as compared with the value of 27.7 per cent. for the mine sample, which included only that section of the seam over the fawn shale marker bed.

Rob Roy Seam

This, the lowest seam in the Blackstone "Stage," is found some 85 ft. below the pavement of the Striped Bacon Seam. Throughout the mine area there is a characteristic coaly band 6 in. to 16 in. thick some 5 ft. above the roof of the seam. This coal band was found in all boreholes which penetrated to the seam, but the interval between it and the roof varied from 4 ft. in N.S. 136 to 17 ft. in N.S. 137. This divergence, accompanied by deterioration of the coal band in N.S. 137, probably accounts for its absence over the Rob Roy Seam in the New Aberdare East area.

The average thickness of the Rob Roy Seam in the four boreholes in which it was penetrated, viz., N.S. 135, 136, 137, and N.S. 138 is 21 ft. 6 in. The seam was generally sampled in three sections of which the top one corresponds as nearly as possible to seam section mined in Whitwood No. 3 Shaft workings. The thickness of this section averages 5 ft. 6 in. in boreholes and 5 ft. 3 in. in mine workings. The ash content is reasonably constant and averages 31·8 per cent. N.S. 137 proves an exception as the ash content of the top section here is 38·4 per cent. However, the ash content of the bottom section is only 30·7 per cent. compared with an average value of 44 per cent. from other bores. This improvement in the quality of the coal in the lower portion of the sampled section of the Rob Roy Seam continues eastward into the New Aberdare East area, where the section worked compares reasonably well with this lower sampled section in N.S. 137.

In each borehole the middle sample embraced a banded coal and shale section approximately 3 ft. thick which carried very high ash values.

A section of coal and shale bands approximately 4 ft. 6 in. thick was usually found underlying the sampled sections in each borehole.

The dominant feature of the seam is the number of fawn shale bands found in it. In the workings alone, seven of these bands varying in thickness from ½ in. to 1½ in. are reasonably constant, and many more are to be found in the underlying part of the seam.

Apart from the present workings from Whitwood No. 3 Shaft the Rob Roy Seam has not been mined on the company's leases.

Seam in Cooneana "Stage"

An unworkable coal seam has been located in several bores at an average of 60 ft. below the pavement of the Rob Roy Seam. This coal horizon was also located in boreholes in the adjacent New Aberdare East mine area.

Structural Geology

Faulting

The New Chum Fault which strikes slightly north of west is known from old workings to be a normal fault with a downthrow of 200 ft. to the N.N.E. Two small normal faults striking approximately N.W. have been encountered south of the New Chum Fault in workings from Whitwood No. 3 Shaft. In the area immediately S.E. and S.W. of No. 3 Shaft, a number of steeply dipping normal faults with throws of up to 20 ft. have been encountered in the Rob Roy Seam workings. This group of faults strikes approximately N.E., tending towards the east.

A fault striking at N. 55 deg. E. and dipping at 55 deg. to N.N.W. forms the northern limit for levels in New Whitwood No. 2 Tunnel. This fault has been penetrated in the upper levels of the mine where it has a downthrow of 12 ft. to the north but a comparison of relevant levels in the Bergin Seam workings from No. 2 Tunnel and from No. 3 Shaft indicates a downthrow of 90 ft. on this fault, or on a series of parallel faults between the two mines.

Minor thrust faults have been seen in No. 2 Tunnel, but in each case they have a very small displacement.

Borehole N.S. 135 penetrated a reverse fault with a throw of 80 ft. Since some thrusting is evident in N.S. 136 to the north, and since the Noblevale No. 2–Belmont No. 3 Colliery workings ended in disturbed country to the west it is probable that a zone of overthrusting extends along a north-south line through N.S. 136 and N.S. 135. A comparison of levels in the New Whitwood Company No. 5 bore and N.S. 136 indicates a downthrow of 50 ft. to the east between the two, evidently along the N.–S. fault which bounded the old Four Feet workings in New Chum No. 4 Tunnel. This fault is assumed to be part of the general N.–S. faulting in this area. To the east, pronounced east-west faulting in the Noblevale No. 2–Belmont No. 3–Happy Valley area has been discussed by A. K. Denmead (1955, p. 98).

South of the Whitwood area the Rhondda fault zone provides a barrier to mine development but the exact nature of the faulting involved is not known.

An overthrust fault block has been mapped in the western portion of the Whitwood area. The thrust plane outcrops along a roughly semicircular line marked at outcrop by overturned beds (see Fig. 1.). It is this overthrust which has pushed the Four Feet Seam outcrop over the underlying workings and is the cause of the zone of steeply dipping strata which provides the dominant structural feature in this section. The influence of this overthrust dies out in the south-west corner of the area, but lack of continuous outcrop obscures its effect in the north-west.

FOLDING

The regional strike swings from N.–S. in the S.W. corner to E.–W. in the northern and eastern sections. Regionally this may represent a change in strike around the nose of the south-pitching syncline which lies east of the main Bundamba anticline. Faulting, with probably large lateral displacement, has obscured the normally developed fold pattern in this area. Minor drag folding associated with the faulting is evident from examination of mine plans of Whitwood No. 3 Shaft workings.

Description of the Coal

The moisture and sulphur contents of the coal are about 2·0 per cent. and 0·30 per cent. respectively, and show little variation from these figures. The average fixed carbon content of the coal from all seams, calculated on a dry, mineral-matter-free basis, is 65·28 per cent., the range being from 63.56 per cent. to 67·10 per cent. The coal is classified as high volatile bituminous.

The calorific value for coal carrying 25·0 per cent. ash is approximately 10,600 B.T.U. per lb.

Core recovery was high in all coal seams.

Washability Tests

All samples submitted for analysis had washability tests carried out on them. The complete results may be found in Table B. The only results of economic interest are those for sample sections of the Striped Bacon Seam, and for the top portion of the Rob Roy Seam over the area in which indicated reserves have been calculated as shown in Fig. 2. Boreholes N.S. 137 and N.S. 145 are outside this area, and accordingly the results of washability tests on samples from these bores are not included in the following summary.

For the Striped Bacon Seam, the full seam section was washed in a medium of specific gravity 1·8. The full seam was not taken in the mine sample from Whitwood No. 2 Shaft as only the section above the fawn shale marker band has been worked. Overall, the discard amounted to 15·5 per cent. and the weighted ash content of the remainder was calculated at 18·5 per cent. Before washing, the samples had an average weighted ash content of 29·7 per cent. Since four samples only were available for calculation the above figures give only an indication of results to be expected and the percentage discard would be nearer 20 per cent. if the bottom section of the seam could have been included in the mine sample.

Results from five samples from the Rob Roy Seam show that on washing at specific gravity 1·8 the total discard amounted to 18·75 per cent., while the weighted ash of the float was calculated at 19·7 per cent. The weighted average ash content of the original samples was 31·8 per cent.

Coal Reserves

It is not proposed to present complete figures for workable reserves because of the highly faulted nature of the area within the Whitwood leases. Lack of information on old mine plans, poor surface exposures over all but the western section of the area and the limited number of boreholes combine to make evaluation of the effect of faulting almost impossible.

Bluff Seam

A small area of coal around N.S. 135 would be workable in the Bluff Seam but its rapid deterioration in all directions from this point determines the occurrence as of little economic interest.

There are no reserves in the seam.

Four Feet Seam

Workable coal exists in the Four Feet Top Coal and Four Feet Seam in the area east of New Whitwood No. 1 Tunnel and south of Whitwood No. 4 Shaft. Since access to the seam cannot be gained through the abandoned No. 1 Tunnel workings and because of major faulting in the area south of Whitwood No. 4 Shaft it is unlikely that any of this coal will be recovered from workings wholly within New Whitwood Colliery leases.

Measured reserves are nil, and no attempt can even be made to classify any area as indicated reserves.

Bergin Seam

Rapid deterioration of this seam takes place to the east of Whitwood No. 3 workings and there are thus no measured reserves. A very limited tonnage of coal remains to be developed from New Whitwood No. 2 Tunnel.

Striped Bacon and Rob Roy Seams

Areas of reserves in the Striped Bacon and Rob Roy Seams are shown in Fig. 2. These are limited to the west by the overthrust zone of steeply dipping strata, to the south by lease boundaries, to the east by faulting, while to the north old or present workings form the boundary. Except around the outer limit of the mine workings the boundary of reserves is the same for both seams. There is every likelihood that coal within this boundary can be extracted economically. The area has been divided into two sections, (i) coal underlying and east of No. 3 Shaft workings, and (ii) coal underlying No. 2 Tunnel workings. This division is based on the presence of the E.N.E. striking fault zone separating No. 3 Shaft workings from No. 2 Tunnel workings.

Striped Bacon Seam

The area over which reserves have been calculated is 118 acres. The seam thickness averages 5 ft. 11 in. and the weighted ash value averages 29·7 per cent., with a specific gravity of 1·544.

Total reserves amount to 1,290,000 tons of which 940,000 tons lies in section (i), accessible from Whitwood No. 3 Shaft, while the remaining 350,000 tons underlies the workings from New Whitwood No. 2 Tunnel.

If this coal were washed in a medium of specific gravity 1·8 reserves would be reduced to 870,000 tons, carrying an average weighted ash content of 18·5 per cent., and with specific gravity 1·422. The sectional tonnages in this case would be (i) 630,000 tons, (ii) 240,000 tons.

Rob Roy Seam

The boundary of reserves encloses an area of 119 acres on this seam, which is workable only in the top section. This has an average thickness of 5 ft. 4 in., and a weighted ash content of 31·8 per cent. The specific gravity is 1·565.

Total reserves amount to 1,190,000 tons which can be sectionally divided into area (i) containing 870,000 tons and area (ii) containing 320,000 tons.

Washing this coal in a medium of specific gravity 1·8 would result in a discard of 25·2 per cent. and a fall in specific gravity to 1·435. On this basis, reserves total 890,000 tons of which 650,000 tons lie in section (i) and 240,000 tons lie in section (ii).

Conclusion

Drilling in portion of the area leased by New Whitwood Colliery Pty. Ltd. has shown that reserves of coal exist in the Striped Bacon and Rob Roy Seams but that future development on the Bergin Seam will be restricted. Indications of heavy faulting in the area may limit economic exploitation of the coal. The total area in which reserves have been calculated has been divided into two sections which will probably have to be mined separately. These two sections are separated by faulting which overall throws the seams down some 90 ft. to the north. The smaller section of 32 acres underlies approximately the workings from New Whitwood No. 2 Tunnel, while the larger area is accessible from No. 3 Shaft.

Total reserves in the area are as follows:—

Striped Bacon Seam.—1,290,000 tons with an average ash content of 29·7 per cent. Washing at specific gravity 1·8 would produce 870,000 tons with an ash content averaging 18·5 per cent.

Rob Roy Seam.—1,190,000 tons with an average ash content of 31·8 per cent. Beneficiation by washing would reduce this tonnage to 890,000 tons with an average ash content of 19·7 per cent.

References

DENMEAD, A. K., 1955: "The West Moreton (Ipswich) Coalfield." *Geol. Surv. Qland* Pub. No. 279.

HAWKINS, B. W., 1957: "Coal Resources, West Moreton (Ipswich) Coalfield, Part 11. P.D.T.S. No. 13 Mine Area, New Aberdare East." *Geol. Surv. Qland* Pub. No. 290.

TABLE A

SHOWING COMPARISON OF TOP COAL AND FOUR FEET SEAM SECTIONS IN NEW WHITWOOD NO. 1 TUNNEL AND DIAMOND DRILLHOLES

—	Whitwood No. 1 Tunnel	N.S. 138	N.S. 135	N.S. 145
	Ft. in.	Ft. in.	Ft. in.	Ft. in.
(*a*) Top Coal (to bottom of fawn sh. with leathery parting, or its equivalent) ..	..	13 0½	11 9¾	10 1½
(*b*) Coal to "boulder" band	..	1 6¾	1 9½	1 8
(*c*) "Boulder"	..	0 3¾	0 5¼	0 1
(*d*) Coal and inf. coal (Brushing Bands) ..	1 1	1 3½	1 1	1 1
(*e*) Double white marker bands	0 4½	0 6¼	0 5	0 4½
(*f*) Coal Main Four Feet Seam	3 4	3 2¼	3 0	3 2
(*g*) Stone and coal ..	0 6	0 6¾	0 4	0 4
(*h*) Inferior coal section	1 0	0 10	0 8¾	0 9¼

NOTE.—In the Whitwood area the "boulder" band provides a roof for the "brushing band" section whereas the fawn shale band with a leathery parting at the base, which is regarded as the top of the "brusing bands" in the Blackheath-Bonnie Dundee area has not always been recognised in the above boreholes.

TABLE B

WASHABILITY TEST PERCENTAGES NEW WHITWOOD AREA

Seam	Four Feet												Bergin		Striped Bacon		
Bore No.	N.S. 135				N.S. 138					N.S. 145			N.S. 138		N.S. 135	N.S. 136	N.S. 137
Sample No.	255/56	256/56	257/56	258/56	270/56	271/56	272/56	273/56	274/56	547/56	548/56	549/56	275/56	276/56	262/56	263/56	269/56
Ash on original sample	30·8	53·2	42·7	19·9	24·6	61·8	43·4	35·6	25·6	33·9	46·0	29·1	29·3	40·7	28·5	31·7	27·2
Floats at 1·4 sp. gr.	37·9	12·8	31·8	55·9	52·4	8·2	25·5	28·9	58·6	36·8	27·2	47·9	51·5	33·0	47·2	53·6	52·4
Ash	8·9	10·1	8·1	9·3	8·5	13·3	10·3	8·6	8·8	11·4	10·0	9·4	9·3	11·2	9·9	9·4	9·2
Floats at 1·6 sp. gr.	30·0	18·4	13·5	26·0	24·2	11·0	23·4	20·5	16·0	30·5	16·1	20·2	19·7	17·2	26·3	17·7	21·0
Ash	22·1	22·7	23·8	19·8	23·2	28·4	24·1	27·6	25·7	28·9	27·9	24·4	26·9	27·2	28·1	23·7	21·6
Floats at 1·8 sp. gr.	8·7	10·3	7·6	8·9	11·6	25·8	18·3	8·1	11·1	7·0	11·4	10·8	9·1	12·0	11·1	11·4	11·6
Ash	49·9	45·5	47·6	55·3	56·0	57·8	55·0	41·1	50·3	44·5	44·0	40·4	46·8	52·6	53·7	50·5	51·5
Sinks at 1·8 sp. gr.	23·4	58·5	47·1	9·2	11·8	55·0	32·8	32·5	14·3	25·7	45·3	21·1	19·7	37·8	15·4	17·3	15·0
Ash	69·9	72·5	72·6	76·9	69·4	73·1	75·1	76·0	75·2	70·5	71·7	71·0	70·1	71·8	71·5	72·7	69·9

Seam	Striped Bacon			Rob Roy													
Bore No.	N.S. 138	N.S. 145	Mine[a]	N.S. 135			N.S. 136		N.S. 137			N.S. 138			Mine[a]		
Sample No.	280/56	742/56	394/57	259/56	260/56	261/56	264/56	265/56	266/56	267/56	268/56	277/56	278/56	279/56	395/57	396/57	
Ash on original sample	32·1	27·1	27·7	32·6	58·5	44·2	31·6	45·6	38·4	55·8	30·7	30·7	57·5	44·6	27·1	35·6	
Floats at 1·4 sp. gr.	52·5	47·4	34·4	41·2	14·6	23·5	43·5	23·5	31·8	1·4	44·3	50·0	10·8	29·8	43·2	49·1	
Ash	11·9	11·1	8·6	8·7	10·4	9·0	9·3	10·3	10·2	11·2	8·9	10·3	13·8	12·5	7·6	9·7	
Floats at 1·6 ap. gr.	17·6	16·2	46·2	24·5	9·1	24·8	24·3	20·1	22·0	22·0	18·7	25·3	8·1	18·8	28·0	22·1	
Ash	25·2	30·6	19·3	26·0	33·2	25·6	25·2	26·5	22·8	30·2	25·9	29·1	28·7	28·0	28·2	28·7	
Floats at 1·8 sp. gr.	12·3	11·3	8·4	12·2	21·8	18·2	15·7	22·7	23·1	29·5	19·7	10·0	26·5	18·0	10·6	7·6	
Ash	47·7	49·9	49·9	48·2	54·2	45·3	50·7	47·2	51·1	48·7	48·5	51·0	52·8	48·5	60·7	61·1	
Sinks at 1·8 sp. gr.	17·6	25·1	11·0	22·1	54 5	33·5	16·5	33·7	23·1	47·1	17·3	14·7	54·6	33·4	18·2	21·4	
Ash	78·8	75·5	74·9	75·4	79·0	76·2	75·1	75·9	73·7	77·6	71·9	73·5	76·5	77·1	79·0	78·9	

a Whitwood No. 3 Shaft

FIG.1

DEPARTMENT OF MINES, QUEENSLAND
GEOLOGICAL MAP
NEW WHITWOOD MINE AREA
IPSWICH COALFIELD
Parish of Goodna
County of Stanley
Showing Geology, Topography & Boreholes

To accompany report by B.W. Hawkins B.Sc.
Surface mapping by D.C. Mengel & J.H. Hill B.Sc.
Topographic Survey by E. Cowley

Scale of Chains

5 4 3 2 1 0 5 10 15 20

Grid of 20 chn. co-ordinates. Meridian of grid is True North at origin an arbitrary point, being bolt in concrete block on road near angle in Eastern boundary of Sub. 1, Por. 213, Parish of Ipswich. Elevations on State Datum.

LEGEND

- Established geological boundary — position accurate
- " " " approx.
- Inferred, probable or indefinite boundary
- Established fault — position accurate
- " " " approx.
- " " concealed
- Inferred, probable or indefinite fault
- " " " " concealed
- High angle fault
- Line of overthrust
- Overturned bed
- Coal seam at surface
- Outcrop
- Strike & dip of strata
- Horizontal strata
- Colliery (Working)
- Colliery (Abandoned)
- Adit
- Shaft
- Diamond drillhole
- Percussion drillhole
- Surface contours
- WHITWOOD / WHITWOOD A
- N.S.00 ◎ / O.P.

Alluvium
Tertiary basalt
" sediments
Bundamba sandstone
Ipswich coal measures ÷
Blackstone "stage"
Cooneana "stage"

140 E V.B. Beikoff del. 160 E 180 E 200 E

LOCALITY MAP
SCALE OF MILES

2½ 2 1½ 1 ½ 0 2½

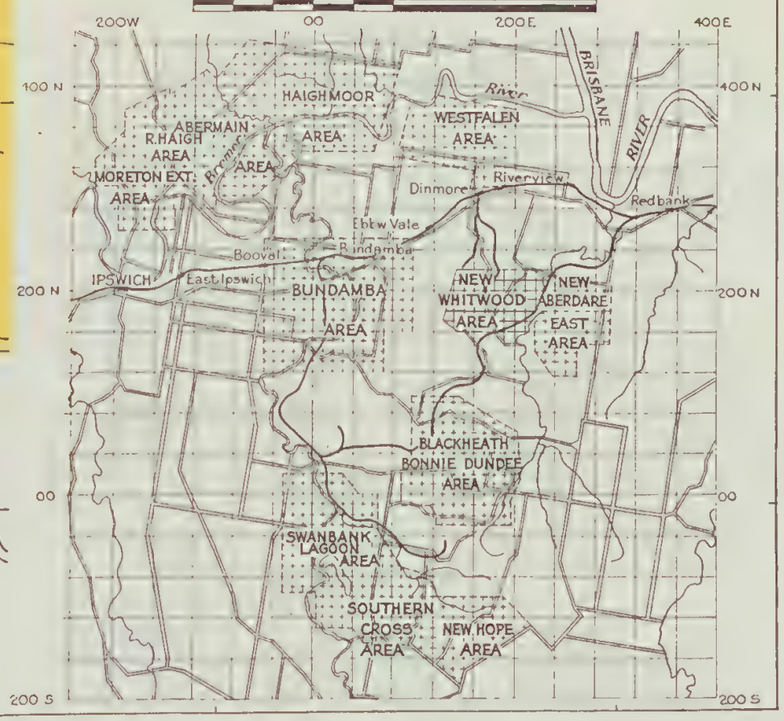
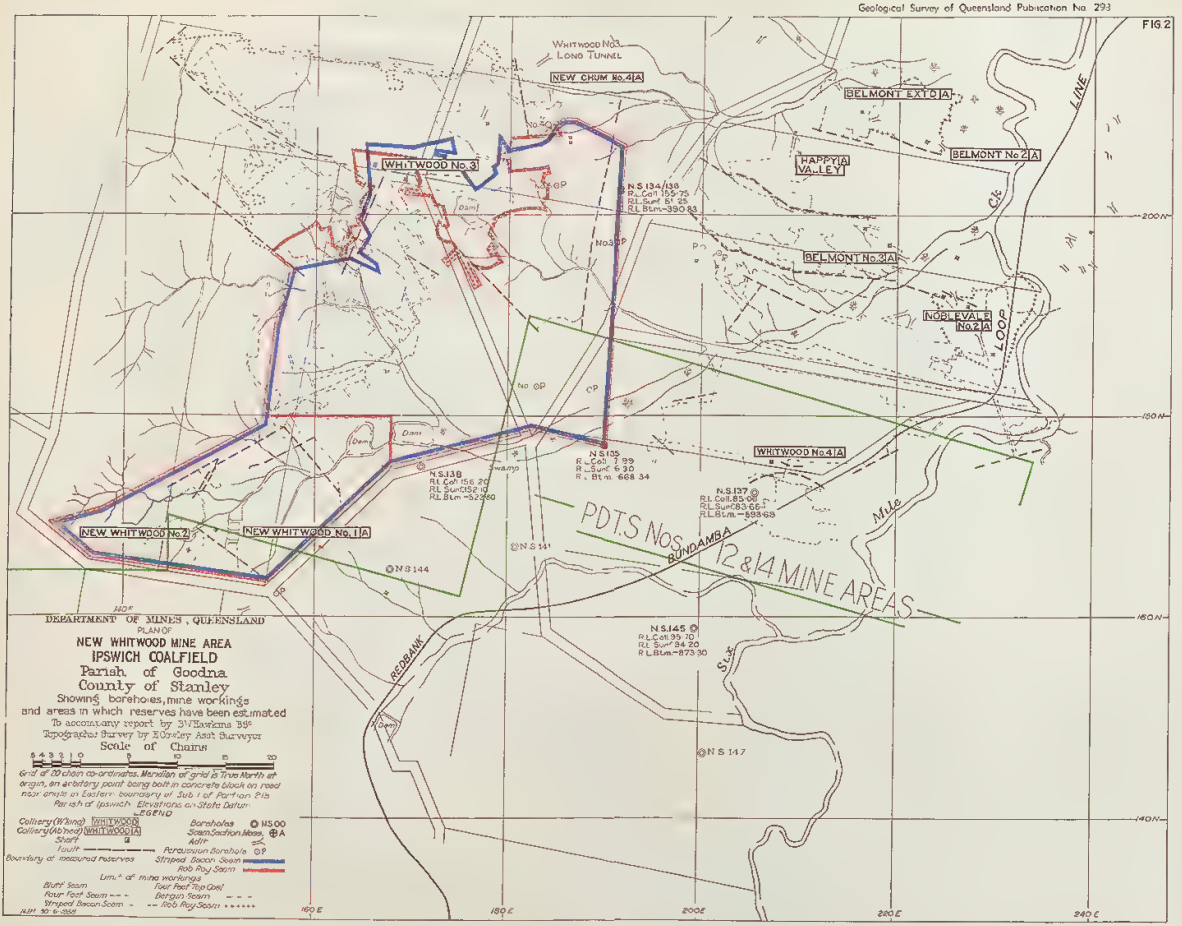


FIG. 2



DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

NEW WHITWOOD MINE AREA
IPSWICH COALFIELD
Parish of Goodna
County of Stanley

Showing boreholes, mine workings and areas in which reserves have been estimated

To accompany report by S.V. Hawkins B.Sc

Topographic Survey by E. Worley Asst. Surveyor

Scale of Chains

5 4 3 2 1 0 5 10 15 20

Grid of 20 chain co-ordinates. Meridian of grid is True North at origin, an arbitary point being bolt in concrete block on road near angle in Eastern boundary of Sub 1 of Portion 21b Parish of Ipswich. Elevations on State Datum.

LEGEND

Colliery (Mining) WHITWOOD
Colliery (Mothballed) WHITWOOD 1A
Shaft
Fault
Boundary of measured reserves
Boreholes N.S.00
Seam Section Moss, A
Adit
Percussion Borehole DP
Striped Bacon Seam
Rob Roy Seam

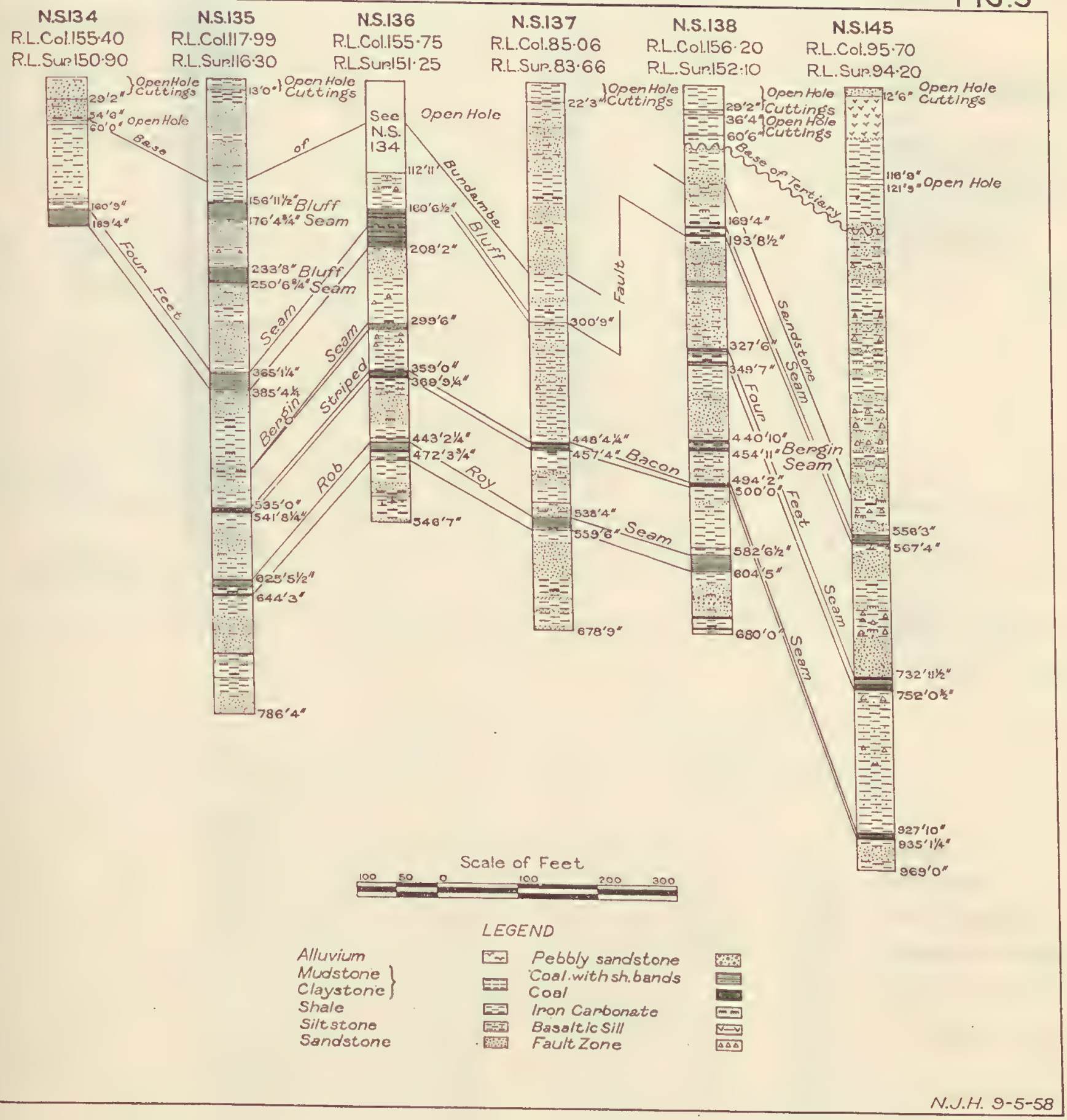
Lim.ts of mine workings
Four Feet Top Coal
Bergin Seam
Rob Roy Seam

Bluff Seam
Four Foot Seam
Striped Bacon Seam

JLH 30-6-1958

NEW WHITWOOD MINE AREA GENERALISED BORE SECTIONS

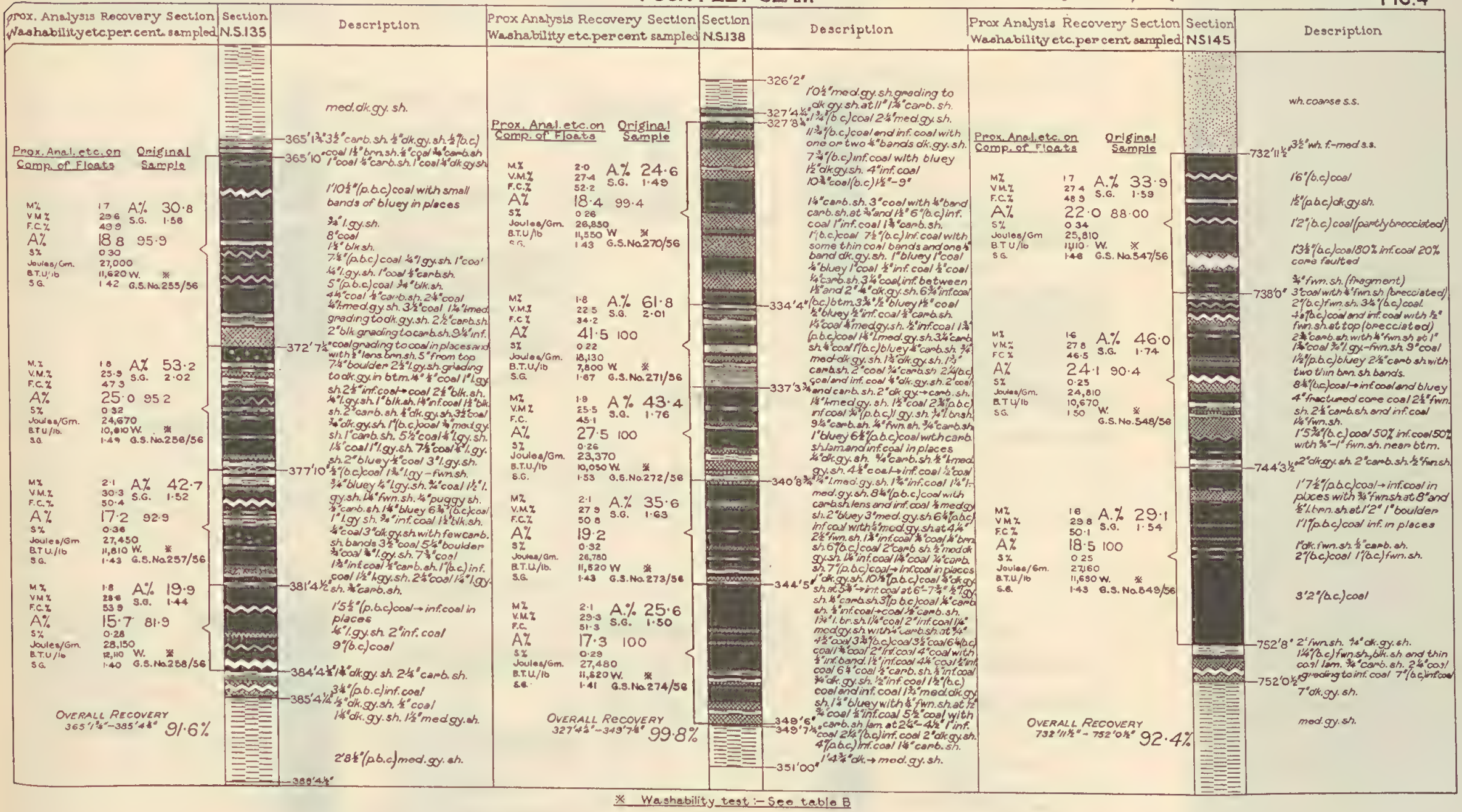
Geological Survey of Queensland Publication No. 293 FIG.3



N.J.H. 9-5-58

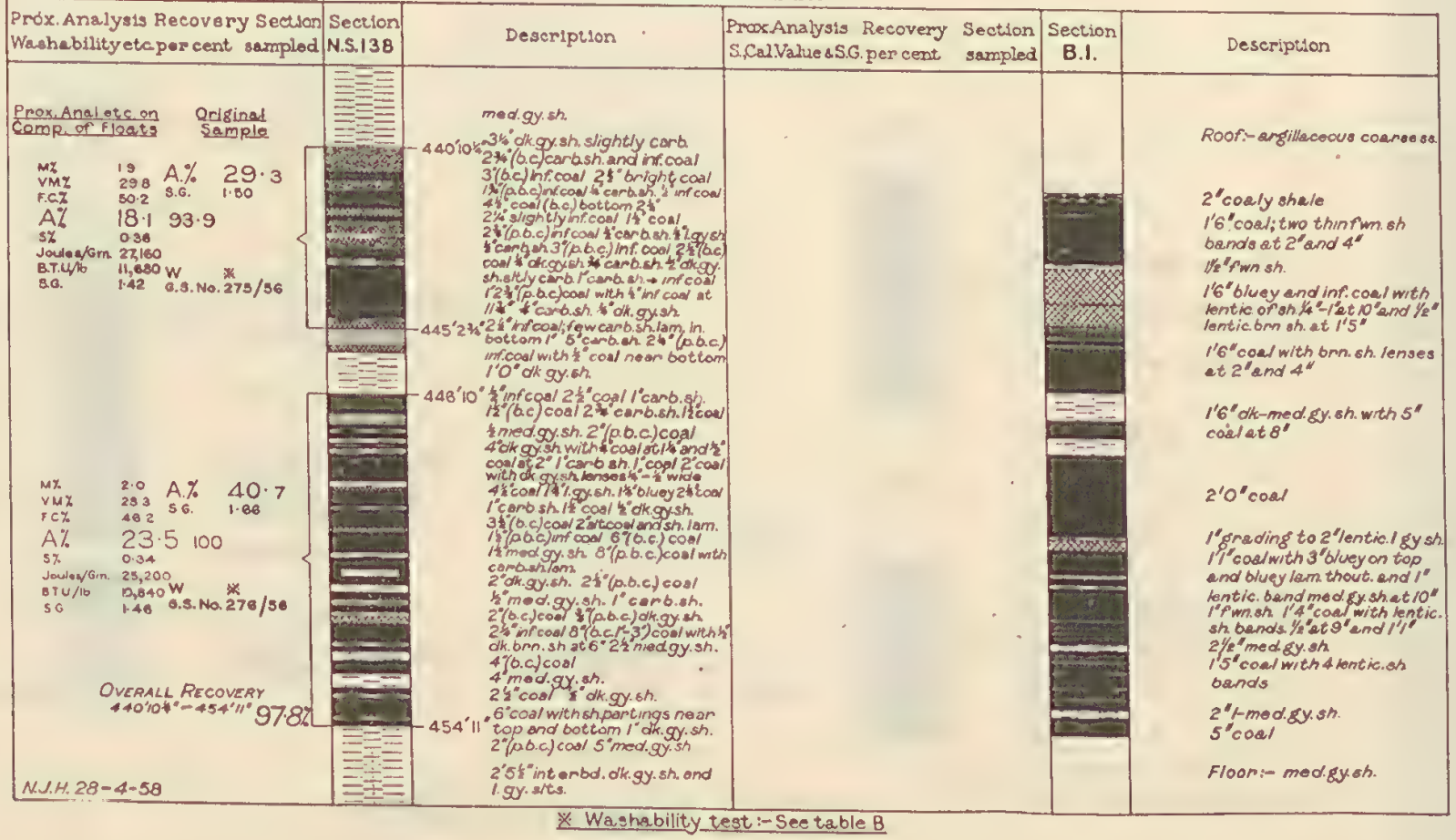
NEW WHITWOOD MINE AREA DETAILED SEAM SECTIONS
FOUR FEET SEAM

Geological Survey of Queensland Publication No 293 **FIG.4**


Prox. Analysis Recovery Section Washability etc. per cent sampled
Section N.S.135
Description
Prox Analysis Recovery Section Washability etc. per cent sampled
Section N.S.138
Description
Prox Analysis Recovery Section Washability etc. per cent sampled
Section NS145
Description
Prox. Anal. etc. on Comp. of Floats
Original Sample
M% 1·7 A% 30·8 S.G. 1·58
V.M.% 29·6
F.C.% 49·9
A% 18·8 95·9
S% 0·30
Joules/Gm. 27,000
B.T.U./lb 11,620 W. ※
S.G. 1·42 G.S. No. 255/56
M% 1·8 A% 53·2 S.G. 2·02
V.M.% 25·9
F.C.% 47·3
A% 25·0 95·2
S% 0·32
Joules/Gm. 24,670
B.T.U./lb 10,810 W. ※
S.G. 1·49 G.S. No. 256/56
M% 2·1 A% 42·7 S.G. 1·52
V.M.% 30·3
F.C.% 50·4
A% 17·2 92·9
S% 0·36
Joules/Gm. 27,450
B.T.U./lb 11,810 W. ※
S.G. 1·43 G.S. No. 257/56
M% 1·8 A% 19·9 S.G. 1·44
V.M.% 28·6
F.C.% 53·9
A% 15·7 81·9
S% 0·28
Joules/Gm. 28,150
B.T.U./lb 12,110 W. ※
S.G. 1·40 G.S. No. 258/56
OVERALL RECOVERY 365'1⅛"–385'4⅛" 91·6%
med.dk.gy. sh.
365'1¾" 3½" carb. sh. ½" dk.gy. sh. ½" (b.c) coal 1½" brn. sh. ½" coal ¾" carb. sh
365'10" 1" coal ½" carb. sh. 1" coal ¼" dk.gy. sh.
1'10½" (p.b.c) coal with small bands of bluey in places
¾" l.gy. sh.
8" coal
1½" blk. sh.
7½" (p.b.c) coal ¼" l.gy. sh. 1" coal
¼" l.gy. sh. 1" coal ½" carb. sh.
5" (p.b.c) coal ¾" blk. sh.
4½" coal ½" carb. sh. 2¼" coal
¼" l. med.gy. sh. 3½" coal 1⅛" l. med grading to dk.gy. sh. 2½" carb. sh.
2" blk. grading to carb. sh. 3¼" inf.
372'7½" coal grading to coal in places and with ½" lens brn. sh. 5" from top
7¼" boulder 2½" l.gy. sh. grading to dk.gy. in btm. 4" ½" coal 1" l.gy. sh. 2¼" inf. coal → coal 2½" blk. sh.
¼" l.gy. sh. 1" blk. sh. 1¼" inf. coal 1½" blk. sh. 2" carb. sh. ½" dk.gy. sh. 3½" coal ¾" dk.gy. sh. 1" (b.c) coal ¾" med.gy. sh. 1" carb. sh. 5½" coal ¼" l.gy. sh. 1½" coal 1" l.gy. sh. 7½" coal ½" l.gy. sh. 2" bluey ½" coal 3" l.gy. sh.
377'10½" (b.c) coal 1¾" l.gy – fwn. sh.
¾" bluey ½" l.gy. sh. ¾" coal 1½" l. gy. sh. 1¼" fwn. sh. ¼" puggy sh.
½" carb. sh. 1¼" bluey 6¾" (b.c) coal 1" l.gy sh. ¾" inf. coal 1½" blk. sh.
¼" coal 3" dk.gy. sh. with few carb. sh. bands 3½" coal 5¼" boulder
¾" coal ¾" l.gy. sh. 7¾" coal 1¾" inf. coal ½" carb. sh. 1" (b.c.) inf. coal 1½" h.gy. sh. 2¼" coal 1¼" l.gy.
381'4½" sh. ¾" carb. sh.
1'5½" (p.b.c) coal → inf. coal in places
¼" l.gy. sh. 2" inf. coal
9" (b.c) coal
384'4¼" 1¼" dk.gy. sh. 2¼" carb. sh.
385'4⅛" 3¼" (p.b.c) inf. coal
½" dk.gy. sh. ½" coal
1¼" dk.gy. sh. 1½" med.gy. sh.
2'8½" (p.b.c) med.gy. sh.
388'4½"
Prox. Anal. etc. on Comp. of Floats
Original Sample
M% 2·0 A% 24·6 S.G. 1·49
V.M.% 27·4
F.C.% 52·2
A% 18·4 99·4
S% 0·26
Joules/Gm. 26,850
B.T.U./lb 11,550 W ※
S.G. 1·43 G.S. No. 270/56
M% 1·8 A% 61·8 S.G. 2·01
V.M.% 22·5
F.C.% 34·2
A% 41·5 100
S% 0·22
Joules/Gm. 18,130
B.T.U./lb 7,800 W ※
S.G. 1·67 G.S. No. 271/56
M% 1·8 A% 43·4 S.G. 1·76
V.M.% 25·5
F.C. 45·1
A% 27·5 100
S% 0·26
Joules/Gm. 23,370
B.T.U./lb 10,050 W ※
S.G. 1·53 G.S. No. 272/56
M% 2·1 A% 35·6 S.G. 1·63
V.M.% 27·9
F.C.% 50·8
A% 19·2
S% 0·32
Joules/Gm. 26,780
B.T.U./lb. 11,520 W ※
S.G. 1·43 G.S. No. 273/56
M% 2·1 A% 25·6 S.G. 1·50
V.M.% 29·3
F.C. 51·3
A% 17·3 100
S% 0·29
Joules/Gm. 27,480
B.T.U./lb 11,520 W. ※
S.G. 1·41 G.S. No. 274/56
OVERALL RECOVERY 327'4½" – 349'7¼" 99·8%
326'2"
1'0½" med.gy. sh. grading to dk.gy. sh. at 11" 1¾" carb. sh.
327'4½" 1¾" (b.c) coal 2¼" med.gy. sh.
327'8¼" 11⅜" (b.c.) coal and inf. coal with one or two ¼" bands dk.gy. sh.
7¾" (b.c) inf. coal with bluey ½" dk.gy. sh. 4" inf. coal
10¾" coal (b.c) 1½" – 9"
1¼" carb. sh. 3" coal with ¼" band carb. sh. at ¾" and 1½" 6" (b.c) inf. coal 1" inf. coal 1⅜" carb. sh.
1" (b.c) coal 7½" (b.c.) inf. coal with some thin coal bands and one ¼" band dk.gy. sh. 1" bluey 1" coal ¼" bluey 1" coal ½" inf. coal ½" coal ½" carb. sh. 3¼" coal, inf. between 1½" and 2" 4" dk.gy. sh. 6¾" inf. coal
334'4" (b.c.) btm. 3¾" ½" bluey ½" coal ½" bluey ½" inf. coal ½" carb. sh. ½" coal ¼" med.gy. sh. ½" inf. coal 1⅜" (p.b.c.) coal 1½" l.med.gy. sh. 3¼" carb. sh. ¼" coal 1" (b.c.) bluey ¼" carb. sh. ¾" med-dk.gy. sh. 1½" dk.gy. sh. 1⅞" carb. sh. 2" coal ¾" carb. sh. 2¼" (b.c. coal and inf. coal ¼" dk.gy. sh. 2" coal
337'3¾" and carb. sh. 2" dk.gy. → carb. sh. 1⅛" l-med.gy. sh. 1½" coal 2¾" (p.b.c.) inf. coal ⅜" (p.b.c.) l.gy. sh. ¼" l. brn. sh. 9½" carb. sh. ¼" fwn. sh. ¾" carb. sh. 1" bluey 6½" (p.b.c.) coal with carb. sh. lam. and inf. coal in places
¼" dk.gy. sh. ¾" carb. sh. ½" l-med. gy. sh. 4½" coal → inf. coal ½" coal
340'8¾" ¼" l.med.gy. sh. 1¾" inf. coal 1⅛" l-med.gy. sh. 8¼" (p.b.c.) coal with carb. sh. lens and inf. coal ⅛" med.gy. sh. 2" bluey 3" med.gy. sh. 6¼" (p.b.c.) inf. coal with ½" med.gy. sh. at 4¼" 2½" fwn. sh. 1¾" inf. coal ¾" coal ¼" brn. sh. 6" (b.c.) coal 2" carb. sh. ½" med dk. gy. sh. 1¼" inf. coal 1¼" coal ¾" carb. sh. 7" (p.b.c.) coal → inf. coal in places
344'5" 1" dk.gy. sh. 10½" (p.b.c.) coal ¼" dk.gy. sh. at 5¾" → inf. coal at 6" – 7½" ½" gy. sh. ½" carb. sh. 3" (p.b.c.) coal ¼" carb. sh. ½" inf. coal → coal ½" carb. sh. 1¾" l. br. sh. 1¼" coal 2" inf. coal 1¼" med.gy. sh. with ¼" carb. sh. at ¼" 4½" coal 3⅜" (b.c.) coal 3½" coal 6¼" (b.c.) coal 1" coal 2" inf. coal 4" coal with ½" inf. band. 1½" inf. coal 4¼" coal ½" inf. coal 6¾" coal ½" carb. sh. ½" inf. coal ¾" dk.gy. sh. ½" inf. coal 1½" (b.c.) coal and inf. coal 1¾" med. dk.gy. sh. 1¼" bluey with ¼" fwn. sh. at ½" ¾" coal ½" inf. coal 5½" coal with
349'6" carb. sh. lam. at 2¼" – 4½" 1" inf. coal 2½" (b.c.) inf. coal 2" dk.gy. sh. 4" (p.b.c.) inf. coal 1⅛" carb. sh.
349'7¼" 1'4¾" dk. → med.gy. sh.
351'00"
OVERALL RECOVERY 732'11½" – 752'0½" 92·4%
wh. coarse s.s.
732'11½" 3½" wh. f–med s.s.
1'6" (b.c) coal
1½" (p.b.c) dk.gy. sh.
1'2" (b.c) coal (partly brecciated)
1'3½" (b.c) coal 80% inf. coal 20% core faulted
¾" fwn. sh. (fragment)
738'0" 3" coal with ¼" fwn. sh (brecciated)
2" (b.c) fwn. sh. 3½" (b.c) coal.
½" (b.c) coal and inf. coal with ½" fwn. sh. at top (brecciated)
2¾" carb. sh. with ¼" fwn. sh at 1"
1⅜" coal ⅜" l.gy. – fwn. sh. 9" coal
1½" (p.b.c) bluey 2½" carb. sh. with two thin brn. sh. bands.
8½" (b.c) coal → inf. coal and bluey
4" fractured core coal 2½" fwn. sh. 2½" carb. sh. and inf. coal
1¼" fwn. sh.
1'5¾" (b.c) coal 50% inf. coal 50% with ⅜" – 1" fwn. sh. near btm.
744'3½" 2" dk.gy. sh. 2" carb. sh. ½" fwn. sh.
1'7½" (p.b.c) coal → inf. coal in places with ⅜" fwn. sh at 8" and ½" l. brn. sh at 1'2" 1" boulder
1'1" (p.b.c) coal inf. in places
1" dk. fwn. sh. ½" carb. sh.
2" (b.c) coal 1" (b.c) fwn. sh.
3'2" (b.c.) coal
752'8" 2" fwn. sh. ¼" dk.gy. sh. 1¼" (b.c) fwn. sh., blk. sh and thin coal lam. ¾" carb. sh. 2¼" coal
752'0½" grading to inf. coal 7" (b.c) inf. coal
7" dk.gy. sh.
med.gy. sh.

※ Washability test :– See table B

NEW WHITWOOD MINE AREA DETAILED SEAM SECTIONS
BERGIN SEAM


Prox. Analysis Recovery Section Washability etc. per cent sampled
Section N.S.138
Description
Prox. Analysis Recovery Section S.Cal. Value & S.G. per cent sampled
Section B.I.
Description
Prox. Anal etc. on Comp. of Floats
Original Sample
M% 1·9 A% 29·3 S.G. 1·50
V.M% 29·8
F.C% 50·2
A% 18·1 93·9
S% 0·36
Joules/Gm. 27,160
B.T.U/lb 11,630 W ※
S.G. 1·42 G.S. No. 275/56
M% 2·0 A% 40·7 S.G. 1·66
V.M% 28·3
F.C% 48·2
A% 23·5 100
S% 0·34
Joules/Gm. 25,200
B.T.U/lb 10,840 W ※
S.G 1·46 G.S. No. 276/56
OVERALL RECOVERY 440'10¾" – 454'11" 97·8%
N.J.H. 28-4-58
med.gy. sh.
440'10¾" 3¼" dk.gy. sh. slightly carb.
2¾" (b.c) carb. sh. and inf. coal
3" (b.c) inf. coal 2½" bright coal
1¾" (p.b.c) inf. coal ¼" carb. sh. ½" inf. coal
4½" coal (b.c) bottom 2½"
2¼" slightly inf. coal 1½" coal
2½" (p.b.c) inf. coal ½" carb. sh. ½" l.gy. sh.
½" carb. sh. 3" (p.b.c.) inf. coal 2½" (b.c) coal ¾" dk.gy. sh. ¾" carb. sh. ½" dk.gy. sh. slightly carb. 1" carb. sh. → inf. coal
1'2½" (p.b.c) coal with ¼" inf. coal at 11¾" ¼" carb. sh. ⅛" dk.gy. sh.
445'2¾" 2½" inf. coal; few carb. sh. lam. in bottom 1" 5" carb. sh. 2½" (p.b.c.) inf. coal with ½" coal near bottom
1'0" dk.gy. sh.
448'10" ½" inf. coal 2½" coal 1" carb. sh.
1½" (b.c) coal 2¾" carb. sh. 1½" coal
½" med.gy. sh. 2" (p.b.c) coal
4" dk.gy. sh. with ¼" coal at 1¼" and ½" coal at 2" 1" carb. sh. 1" coal 2" coal with dk.gy. sh. lenses ¼" – ½" wide
4½" coal 1¾" l.gy. sh. 1⅛" bluey 2½" coal
1" carb. sh. 1½" coal ½" dk.gy. sh.
3½" (b.c) coal 2" at coal and sh. lam.
1½" (p.b.c) inf. coal 6" (b.c.) coal
1½" med.gy. sh. 8" (p.b.c.) coal with carb. sh. lam.
2" dk.gy. sh. 2½" (p.b.c.) coal
½" med.gy. sh. 1" carb. sh.
2" (b.c.) coal ½" (p.b.c.) dk.gy. sh.
2¾" inf. coal 8" (b.c. 1'–3") coal with ½" dk. brn. sh at 6" 2½" med.gy. sh.
4" (b.c) coal
4" med.gy. sh.
2½" coal ¼" dk.gy. sh.
454'11" 6" coal with sh. partings near top and bottom 1" dk.gy. sh.
2" (p.b.c) coal 5" med.gy. sh
2'5½" interbd. dk.gy. sh. and l.gy. s/ts.
Roof :– argillaceous coarse ss.
2" coaly shale
1'6" coal; two thin fwn. sh bands at 2" and 4"
1½" fwn sh.
1'6" bluey and inf. coal with lentic of sh. ¼" – 1" at 10" and ½" lentic. brn sh. at 1'5"
1'6" coal with brn. sh. lenses at 2" and 4"
1'6" dk – med.gy. sh. with 5" coal at 8"
2'0" coal
1" grading to 2" lentic. l gy sh.
1'1" coal with 3" bluey on top and bluey lam. thout. and 1" lentic. band med.gy. sh. at 10"
1" fwn. sh. 1'4" coal with lentic. sh. bands. ½" at 9" and 1'1"
2½" med.gy. sh.
1'5" coal with 4 lentic. sh bands
2" l – med.gy. sh.
5" coal
Floor :– med.gy. sh.

※ Washability test :– See table B

NEW WHITWOOD MINE AREA, DETAILS OF CORE RECOVERY & ANALYSIS, DIAGRAMS OF STRIPED BACON SEAM

Geological Survey of Queensland Publication No. 293 **FIG.5**

N.S.135

Prox Analysis Recovery Washability &c. per cent — Section sampled — Section N.S.135 — Description

Prox. Anal. etc. on Comp. of Floats

M.%	2·0	A.%	28·5
V.M.%	29·6	S.G.	1·53
F.C.%	48·9		
A.%	19·5	93·77	
S.%	0·31		
Joules/Gm.	28,860		
B.T.U./lb.	11,560	W.	*
S.G.	1·43	G.S. No. 282/56	

Original Sample

Overall Recovery 95·5% 532'4" to 541'8¼"

532'4"	1'4" interb. l.gy. slts. & dk gy. sh.
	1'4" dk. gy. sh. & med gy. slts. irreg. interb.
535'0"	11" coal
	1½" inf. coal 1" carb. sh. w. few coal lents. 6" coal → inf. coal in places ¼" l. to med. gy. sh. 7½" (p.b.c) coal
	2" carb. sh. w. coal lents. 5½" coal ¾" dk. gy. s.h. 3½" coal ½" (b.c) dk. to med gy. sh. 1½" coal → inf. (b.c) in top" ½" med gy. to brn. sh. 1" coal 3" bluey ¼" coal ¼" (b.c) l. gy. sh. 3¼" coal → inf. in places (b.c) in top 1'2" l. gy. sh. w dk gy. sh. lents. & lam. 1'1½" coal (b.c) in top 8"
	¼" fn. sh. 7¼" coal w. 2" (b.c) coal
541'8¼"	4½" from top ¼" carb. & dk gy. sh w. coal lents. 2" dk gy. sh. ½" bluey
	dk. to med. gy. sh. w. coal lents. in top

N.S.136

Prox Analysis Recovery Washability &c. per cent — Section sampled — Section N.S.136 — Description

Prox. Anal. etc. on Comp. of Floats

M.%	1·9	A.%	31·7
V.M.%	29·3	S.G.	1·51
F.C.%	51·7		
A.%	17·1	95·16	
S.%	0·30		
Joules/Gm.	27,590		
B.T.U./lb.	11,870	W.	*
S.G.	1·41	G.S. No. 283/56	

Original Sample

Overall Recovery 358'1" to 370'7" 94·0%

358'1"	11" dk gy. sh. w. few coal lents. in btm. 1"
359'0"	3'0" thin coal & bluey beds (b.c) in top 1'3" & (p.b.c) in btm. 6"
	6" (p.b.c) coal
	1¼" dk. gy. sh.
	6¼" (p.b.c) coal grdng. to inf. in places 2¼" l. gy. sh. ½" carb. sh. 4½" inf. coal w. ¼" med. gy. sh. lens at 3½" h. 1¼" (p.b.c) coal 3½" coaly sh.
	11½" (p.b.c.) coal
365'10½"	1½" carb. sh. w. few coal lam.
	1¼" (b.c.) coal 1¼" (b.c.) dk. gy. sh.
	8" interbd. dk & l gy. sh. w. few coal lents. in btm. 1½" [illegible] inf. coal w. sh. lents. 1¾" dk gy. s.h. 4" coaly sh
	1" dk. gy. sh ½" inf. coal 1½" [illegible]
	9½" med. to dk gy. sh (p.b.c) at 2 to 3
	3½" carb. sh w. coal lents.
	2" med. to dk gy. sh.
	2½" l. gy. sh. 5¼" dk. gy. sh.
	1" coal to inf. coal (p.b.c.)
	7¾" med. gy. sh. w. coal lam. in btm.
370'7"	3"
	dk. gy. sh. w few coaly lam. in btm 6"

N.S.137

Prox. Anal. etc. on Comp. of Floats — Original Sample

M.%	2·0	A.%	27·2
V.M.%	28·4	S.G.	1·52
F.C.%	51·3		
A.%	18·3	91·67	
S.%	0·32		
Joules/Gm.	27,080		
B.T.U./lb.	11,650	W.	*
S.G.	1·42	G.S. No. 269/56	

Overall Recovery 92·97% 446'8" to 457'4"

446'8"	1'8¼" interbd. dk. gy. sh., med. & l. gy. slts. w. 1" l. gy. sh. at btm.
448'4¼"	½" coaly sh.
	3'1" coal w. bluey bands in top 6", sh. prtns. at 1'4" & 1'6" and ¼" to ½" lens at 1'7", 1'9" & 2'2"
	¾" med. gy. sh.
	8" coal
	3¼" l. brn. sh., coal lam. in btm 1"
	½" coal 2" bluey 1" coal ½" med. gy. sh.
	2½" coal & inf. coal 1½" carb. sh. w. coal lents.
	1'0½" coal, sh lam. in btm 3"
	2" carb. sh. w. coal lam. → bluey
	7¾" coal
455'10"	½" l. gy. sh. 3½" (p.b.c) coal ¾" med gy. sh 1" coal ¼" med. gy. sh.
	2" (b.c) inf. coal 3½" med. gy. sh.
	½" carb. sh. 2" inf. coal 1" carb. sh.
457'4"	4" (b.c.) coal
	med. gy. sh.

N.S.138

Prox. Anal. etc. on Comp. of Floats — Original Sample

M.%	1·8	A.%	32·1
V.M.%	27·2	S.G.	1·62
F.C.%	52·2		
A.%	18·8	95·00	
S.%	0·34		
Joules/Gm.	26980		
B.T.U./lb.	11,610	W.	*
S.G.	1·43	G.S. No. 280/56	

Overall Recovery 493'4" to 502'6½" 96·13%

493'4"	10" med gy slts.
494'2"	2'0½" (p.b.c) coal w. 2sh. lam.
	½" med. gy. sh. 4½" coal → dull coal ¾" brn. sh.
	1'3" coal, (b.c) from 4" to 1'3"
	3" fn. sh.
	9" (b.c.) coal & bluey
	1" l. gy. sh.
	2¼" (p.b.c.) inf. coal 6" (p.b.c.)
500'0"	coal with bluey bands
	2'6½" med. gy. sh. → slts. in places
502'6½"	

N.S.145

Prox. Anal. etc. on Comp. of Floats — Original Sample

M.%	2·2	A.%	27·1
V.M.%	28·2	S.G.	1·62
F.C.%	47·6		
A.%	22·0	82·29	
S.%	0·33		
Joules/Gm.	25450		
B.T.U./lb.	10950	W.	*
S.G.	1·46	G.S. No. 742/56	

Overall Recovery 925'5" to 935'1½" 85·49%

925'5"	1'7" l. gy. f. ss.
	3" dk. gy. sh. 1" fn. sh.
927'10"	6" carb. sh. & some coal (b.c.)
	10" (b.c.) coal
	2'2½" (b.c) coal
	2" inf. coal 2½" med. gy. sh.
	6" (b.c.) coal
	1" (b.c) fn. to med. gy. sh.
	4½" (b.c.) coal
	1'7½" (b.c.) coal
935'1½"	2" (p.b.c.) med. gy. sh.
	dk. gy. sh., 2" inf. coal at 8" & 3" inf. coal at 1'3"

S.B.1

	Roof → slts.
	7" coal
	½" lentic. brn. sh.
	2'8" coal w. ½" dk. gy. sh. at 2'1"
	5'7½"
	2" dk. gy. sh. w. carb. & coal lents. in btm. ¾"
	2'2" coal w. penny band at 1'5"
	Floor → med. gy. sh.

S.B.2

Prox. Anal. etc. on Comp. of Floats — Original Sample

M.%	2·5	A.%	27·7
V.M.%	27·1	S.G.	1·53
F.C.%	52·4		
A.%	18·0		
S.%	0·38		
Joules/Gm.	26840		
B.T.U./lb.	11550	W	*
S.G.	1·44	G.S. No. 284/57	

	Roof → med. gy. sh.
	11" coal
	½" med. gy. sh. 1½" coal ½" med gy. sh.
	1'0" coal w. few thin sh. bands at 8"
	4'3½" and → inf. coal in btm. 4"
	½" dk. gy. sh.
	6½" coal, slightly inf.
	1" dk gy. sh.
	6" coal
	1½" med. gy. sh.
	10½" coal
	1" fn. sh.
	Floor → coal & sh. bands

V.B.B. 3.6.58

To accompany report by B.W. Hawkins B.Sc.

* Washability test :– See table B

NEW WHITWOOD MINE AREA DETAILS OF CORE RECOVERY & ANALYSIS DIAGRAMS OF ROB ROY SEAM

Geological Survey of Queensland Publication No. 293 FIG. 6.

Prox Analysis Washability etc.	Recovery percent	Section Sampled	Section N.S.135	Description
				622'0" 6" l.g.y. f. ss.
				2'10½" dk.gy.sh.
Prox. Anal. etc on Comp. of Floats: M% 1·9, V.M.% 28·4, F.C.% 49·7, A% 20·0, S% 0·33, Joules/Gm. 26830, B.T.U./lb. 11540, S.G. 1·43; Original Sample: A.% 32·6, S.G. 1·57, W. %, G.S. No. 258/56	98·2			625'5½" 1" l.gy.sh. ¼" carb.sh. 2½" inf. coal ¼" f'wn.sh. 10¾" coal (b.c.) 3" to 6" 1" l-med.gy.sh. 3¾" carb.sh. & bluey 1" f'wn.sh. 4" inf. coal 3" carb.sh. 1'4" coal → inf. coal in places in top 8" 1" l. → f'wn.sh. ¾" inf. coal 1½" l.gy.sh. 3" inf. coal 1½" carb.sh.
				630'0½" 4" coal 1½" f'wn.sh. ¾" carb.sh. ¾" f'wn.sh. ½" carb.sh → f'wn.sh. 2" carb.sh. 1½" f'wn.sh. ¾" inneg. lens coal & carb.sh. ¼" lens f'wn.sh. 4½" (p.b.c) coal & inf. coal 3" coal 3¾" f'wn.sh. 2" carb.sh. 1'1½" m.gy.sh. 1¼" carb.sh. ¼" inf. coal 1" f'wn.sh. 1¾" carb.sh. 3" coal
M% 1·7, V.M.% 26·4, F.C.% 47·0, A% 24·9, S% 0·34, Joules/Gm. 24980, B.T.U./lb. 10740, S.G. 1·45; A% 44·2, S.G. 1·73, W. %, G.S. No. 261/56	100			633'4" → inf. coal 2½" f'wn.sh. 3" carb.sh. 2" f'wn.sh. 7" coal 1" l.gy.sh. 3¾" inf. coal 1" carb.sh.
				10½" coal ½" blk.sh. 2" coal ½" brn.sh. 1¼" coal 1" f'wn.sh. 1¼" carb.sh 1" coal 1¾" f'wn.sh. 4" coal ¾" carb. → f'wn.sh. 1" inf. coal ¼" med.gy.sh. ½" f'wn.sh. ½" blk.sh 2¼" inf. coal 1" carb.sh 1" f'wn.sh 6¼" bluey & carb.sh. 2" coal 2¾" inf. coal ½" f'med gy.sh. ¾" carb.sh. 3" f'med. gy.sh. 4¼" int. bd. carb. & f'wn.sh 1¼" boulders 1¾" carb.sh ½" inf. coal 1" l.gy.sh. ½" carb.sh. 4¾" (p.b.c) coal 2" bluey 4¼" coal 1½" l.gy.sh. 1" carb.sh. ½" inf. coal ¼" med.gy.sh. ¾" carb.sh. 1" coal ¼" dk.gy.sh. ½" coal ¾" carb.sh. 1" coal y.sh ¼" inf. coal 1" coal 1½" l.gy.sh.
				642'7¼" 2¼" inf. coal ½" f'wn.sh. 2½" carb.sh. 1" coal 3½" f'med.gy.sh. 2 ¼" bluey 6¼" coal (b.c) 4" to 5" ¾" bluey ½" coal 1¾" bluey 4¾" dk.
				644'3" gy sh. 1" (p.b.c) coal ¼" l gy sh. 1½" carb.sh. ¾" med-l.gy.sh 2¾" inf. coal → bluey 1½" (b.c) coal 1½" l. gy.sh. 6" (b.c.) coal 1'3" dk.gy.sh.
Overall Recovery 625'5½"-644'3" 99·1%				1'3" dk.gy.sh.
				647'5"
			RR1	
				Roof:- med-dk.gy.sh.
				3" coal 1½" f'wn.sh.
				1'4" coal
				½" f'wn.sh. 4½" coal 1" bluey ½" f'wn.sh. 6½" coal ¼" f'wn.sh.
				5'10" 1'1" coal
				½" f'wn.sh.
				11" coal 1" f'wn.sh. 2½" coal 1½" f'wn.sh. 5" coal 2" inf. coal & carb.sh.
				Floor:- l.gy.sh.

Prox Analysis Washability etc.	Recovery percent	Section Sampled	Section N.S.137	Description
				l.gy.sh.
				7" med.gy.sh.
Prox. Anal. etc on Comp. of Floats: M% 1·8, V.M.% 25·6, F.C.% 45·4, A% 27·2, S% 0·23, Joules/Gm. 24000, B.T.U./lb. 10320, S.G. 1·50; Original Sample: A% 38·4, S.G. 1·63, W. %, G.S. No. 266/56	94			538'4" 1" sooty coal 3" (b.c.) carb.sh. & bluey with some coal 10" (p.b.c.) coal
				2¼" bluey 2½" inf. coal 1¾" carb. sh.
				1'4¼" coal
				½" coal ¼" med-dk.gy.sh. 3" coal 4" (b.c.) coal ½" f'wn.sh.
M% 1·9, V.M.% 24·6, F.C.% 34·2, A% 39·7, S% 0·13, Joules/Gm. 18820, B.T.U./lb. 8100, S.G. 1·68; A% 55·8, S.G. 1·90, W. %, G.S. No. 287/56	100			8" (b.c.) 2" f'wn.sh. 1" coal 1" dk.gy.sh. → f'wn. sh. 3" (p.b.c.) bluey 1¼" l.gy.sh.
				8" (b.c.) coal 25% carb.sh. 12% inf. coal 50% f'wn.sh. 12% 1¼" (b.c.) inf. coal 3½" f'wn. sh 1½" very inf. coal 5¾" carb.sh 1" inf. coal
				544'8" 2" carb.sh. 2" inf. coal 2½" f'wn.
				546'7¾" sh. 4½" carb.sh.
				9¾" coal
				½" l.gy. sh. 2" inf. coal 2½" coal 1" f'med.gy.sh. 2½" coal 1" carb.sh.
				1'1¼" coal
M% 1·8, V.M.% 28·1, F.C.% 48·1, A% 22·0, S% 0·27, Joules/Gm. 25630, B.T.U./lb. 11030, S.G. 1·45; A.% 30·7, S.G. 1·57, W. %, G.S. No. 268/56	100			½" bluey 3¼" coal and inf. coal ¾" f'med.gy.sh. 1" coal ¾" carb. sh → inf. coal 1" f'wn. sh. 2" carb. sh. 7" coal 1¼" l.gy.sh. ¾" carb.sh 6¼" coal ½" blk.sh. 2½" coal → inf. coal 2" coal 3½" inf. coal
				552'4¾" 3½" coal ¼" boulder 1¼" bluey 1" brn.sh. ½" carb.sh. 2½" inf. coal 3½" med.gy.sh. 2¼" inf. coal 3" very inf. coal 4¼" inf. coal 3½" carb.sh.
				¾" coal 2¾" med.gy.sh.
				11½" bluey → carb. sh. in places ½" coal 2" dk.gy.sh. 3" coal 4" dk. → med.gy.sh. 1¼" boulder
				10½" (p.b.c) coal
				1'0½" carb.sh.
				8" blk.sh.
Overall Recovery 538'4"-559'6" 98·2%				559'6" 2½" f'wn.sh. 1" carb.sh. 1½" (b.c.) coal ½" bluey
				dk.gy.sh.
			RR2	
				Roof:- med-dk.gy.sh.
Prox. Anal. etc. on Comp. of Floats: M% 2·3, V.M.% 27·7, F.C.% 48·6, A% 21·4, S% 0·37, Joules/Gm. 26440, B.T.U./lb. 11370, S.G. 1·45; Original Sample: A.% 27·1, S.G. 1·51, W. %, G.S. No. 395/57				3" med-dk.gy.sh. with ½" coal at 1½"
				2" coal ½" med.gy.sh. 1" inf. coal 1" coal 1½" med.gy.sh.
				1'3½" coal
				¾" brn.sh.
				6'3½" 5" coal & inf. coal 1" f'wn.sh. 4" coal ½" f'wn.sh. 1½" bluey ½" coal
				¾" f'wn.sh. 1'1½" coal
				1" f'wn.sh.
				1'1½" coal
				Floor:- med.gy.sh.

Prox Analysis Washability etc.	Recovery percent	Section Sampled	Section N.S.138	Description
				med. → dk.gy.sh.
				582'6½" 3" (b.c.) coal ½" dk.gy.sh.
				1'4" coal (b.c.) 11½" to 1'2"
Prox. Anal. etc on Comp. of Floats: M% 2·0, V.M.% 27·5, F.C.% 50·3, A% 20·2, S% 0·34, Joules/Gm. 26790, B.T.U./lb. 11530, S.G. 1·43; Original Sample: A.% 30·7, S.G. 1·52, W. %, G.S. No. 277/56	95·4			¾" f'wn.sh. 3¼" coal ⅛" dk.gy.sh. 2" inf. coal → coal in places 1" f'wn. sh. 4¾" coal ½" f'wn.sh. 2½" inf. coal
				7" coal (b.c.) in top 5" 6" coal (b.c.) 2" to 5" ½" carb.sh. 5¾" coal (b.c.) 3½" to 4½" ¾" f'wn.sh. 2¼" coal 1" f'wn.sh. 4¼" coal → inf. coal 1" carb.sh.
M% 2·1, V.M.% 28·5, F.C.% 29·4, A% 39·4, S% 0·21, Joules/Gm. 19130, B.T.U./lb. 8263, S.G. 1·65; A% 57·5, S.G. 1·86, W. %, G.S. No. 278/56	100			588'5¼" 4½" coal (b.c.) btm. 1½" ⅛" carb. sh 1" f'wn. sh. 1" carb. sh. 1" f'wn. sh. ½" carb. sh. ½" carb. sh. ½" f'wn. sh. ½" carb. sh. 1" f'wn sh. 1⅛" bluey → inf. coal 3¼" coal ¼" f'wn. sh. 3" coal 1½" carb. sh. 2¼" f'wn. sh. 6¼" inneg. interbd. carb. & f'wn. sh 1" puggy. sh. ⅛" carb. sh. 2½" inf. coal ¾" f'wn. sh. 1" carb. sh. ¾" f'wn. sh. 1¼" coal 1" carb. sh. ½" inf. coal 1½" f'wn. sh 1" carb. sh. 1" bluey 3¼" carb. sh. 1½" f'wn. sh 1" inf. coal 7" coal 1½" (b.c.) coal ¾" f'wn. sh. 1" carb. sh ¾" f'wn. sh. ¼" carb. sh. 2" coal 1" bluey 8" coal (p.b.c) top 2¾" (b.c.) 2¾" to 5¾" 1½" carb. sh. ½" inf. coal 1" coal ½" f'wn. sh ½" coal ¼" carb. sh. ¾" f'wn. sh. 1" carb. sh 1" inf. coal 1¾" coal 2½" f'wn. sh. 3⅛" coal ¾" f'wn. sh. ¼" carb. sh. ½" inf. coal 1" f'wn. sh. 3" (p.b.c) inf. coal 1" sneg. interbd. f'wn. & carb. sh. 10" coal (b.c.) btm. 8" → inf. in top 2" 3¾" f'wn. sh. ⅛" carb. sh. 3" coal 1⅜" f'wn. sh. 1¼" coal 1" carb. sh. 1" bluey
				592'0" 5⅛" coal 4¼" bluey
M% 1·9, V.M.% 26·0, F.C.% 45·6, A% 26·5, S% 0·31, Joules/Gm. 24230, B.T.U./lb. 10430, S.G. 1·50; A% 44·6, S.G. 1·73, W. %, G.S. No. 279/56	97			¾" (b.c.) coal 1¼" bluey → inf. coal in few places 1½" f'wn. sh. ½" carb. sh. 1¾" bluey to inf. coal 5¾" coal (b.c.) btm. 4" 1" dk.gy.sh. ½" carb. sh. 1" inf. coal 2" coal ¼" f'wn. sh. 1" coal 1½" bluey (b.c.) top ¾" ¾" coal 1¾" f'wn. sh. 2⅛" carb. sh. 3" f'wn. sh. 2¼" bluey 5¼" coal (b.c.) btm. 2½" ¼" f'wn. sh ¾" inf. coal 7½" coal (b.c.) btm. 5" 2½" dk.gy.sh. ¾" coal 1½" bluey 2" coal (b.c.) top ¾" 1½" med.gy. → f'wn. sh. 1⅛" inf. coal 5¼" (b.c.) coal 1¼" med.gy.sh.
				604'5" 10½" (b.c.) coal 1" inf. coal 1½" carb. sh. 7" l.gy.sh. 1" carb sh.
				8" dk.gy.sh.
				606'2" 3½" carb.sh.
			RR3	
				Roof:- med.gy.sh.
				2½" inf. coal 1" f'wn. sh.
				1'2½" coal
				1" brn. sh.
				9" coal
				5'3¼" ⅛" med.gy.sh. 2" coal ¾" f'wn. sh.
				1½" coal
				½" f'wn. sh.
				9" coal
				1" f'wn. sh. 1⅛" coal 1" f'wn. sh.
				5" coal 1" carb. sh.
				Floor:- med. gy. sh.

Prox Analysis Washability etc.	Recovery percent	Section Sampled	Section N.S.136	Description
				440'6"
				2'8" dk.gy.sh.
				443'2¼" 2" (b.c) coal 6½" (b.c. bot. 1") inf. coal
				3'6½" dk.gy.sh.
Prox. Anal. etc on Comp. of Floats: M% 1·3, V.M.% 29·4, F.C.% 51·6, A% 17·1, S% 0·31, Joules/Gm. 27890, B.T.U./lb. 12000, S.G. 1·41; Original Sample: A.% 31·6, S.G. 1·55, W. %, G.S. No. 264/56	94·2			447'9¼" 1" inf. coal
				1'8" coal → inf. coal in places
				¾" f'wn. sh, 1¼" carb. sh. 4" coal → inf in places (b.c) 1" to 3" ½" f'wn. sh. 2½" coal 3½" carb sh. → inf. coal 2¾" carb. sh. 3" coal 1" inf. coal 1½" inf. coal → coal
				1'2" (p.b.c.) coal → inf. in places
				1½" f'wn. sh. 1⅝" inf. coal 1½" f'wn. sh. 5" inf. coal → coal
				453'3¾" 2" carb. sh. → bluey 1" f'wn. sh. ¾" carb. sh. ¾" f'wn. sh. 5" inf. coal → coal 1½" f'wn. sh. ½" inf. coal 8" (b.c.) coal
				4" f'wn. sh. 2" puggy dk. gy. sh. 10" (b.c.) coal 60% inf. coal 20%, carb. sh. 10% & 1" f'wn. sh near top
M% 1·8, V.M.% 26·0, F.C.% 44·8, A% 27·4, S% 0·25, Joules/Gm. 23640, B.T.U./lb. 10170, S.G. 1·51; A% 45·6, S.G. 1·74, W. %, G.S. No. 265/56	100			¼" coal ¾" carb. sh. 5" (p.b.c.) f'wn. sh. 3" bluey ½" carb. sh. 6" (p.b.c.) coal ¼" carb. sh. ¾" f'wn. sh. ½" carb. sh. ½" (p.b.c.) carb. sh. → inf. coal in places 1" f'wn. sh. 1¼" (p.b.c.) coal ½" dk.gy.sh. ½" l.gy. sh. 8½" coal (b.c.) btm. 2" 1" f'wn. sh. 1" inf. coal 1" f'wn. sh. 1" inf. coal 4" coal 1¾" f'wn. sh.
				1'4½" coal → inf. in places
				462'4½" 3" l.gy.sh. 1½" carb. sh. 1½" l.gy.sh. 4¼" coal 3¼" l.gy. sh. 1" carb. sh. 5¾" coal 1" carb. sh. 5" bluey → inf. coal in places 1¼" f'wn. sh. 2½" carb. sh → bluey ¾" f'wn. sh. ½" carb. sh. 1¼" dk.gy. sh. → carb sh. 1" inf. coal ¾" f'wn. sh. 2" bluey 1½" coal 1¾" f'wn. sh. ¾" carb. sh. 2½" coal → inf. coal ½" carb. sh. 5" f'wn. sh. 5" bluey 4" coal (b.c.) top & btm 1". 2" bluey 1" carb. sh. 3½" dk. gy. sh. 5½" coal → inf. in places ¾" l.gy.sh. 5¼" coal 2" l. gy. sh. 7½" coal 1⅛" inf. coal 4½" blk. sh. 10½" l.gy. sh. 7½" (p.b.c.) dk.-med. gy sh
				8" f'wn. sh.
				6" inf. coal & coal beds 2" dk. gy. sh. 2" inf. coal
				473'3¾" 1½" dk. gy. sh. 3¼" coal → inf. 7" l.gy.sh.
Overall Recovery 443'2¼"-473'3¾" 98·4%				dk. gy. sh.

N.J.H. 20-6-1958

* Washability test :- See table B

PART 13—COONEANA ESTATE MINE AREA

SUMMARY

This report sets out the results of the first systematic diamond drilling to test a seam in the Cooneana "Stage" of the Ipswich Coal Measures.

Based initially on a coal section penetrated at about 140 ft. in borehole N.S. 93 (1954), a shallow drilling programme proved reserves in the Cooneana Estate. Fifteen holes (including one redrill) were completed to depths ranging from 128 ft. 8 in. to 844 ft. 11 in. Total footage drilled was 4,517 ft. 9 in.

Because mining experience had shown that workable areas of seams occurring in the Cooneana "Stage" were of small extent, a close grid was adopted in the early stages of testing, in the expectation that similar conditions would apply here. Indications that the seam was more persistent allowed a later increase in drilling interval.

Although coal was penetrated at a number of horizons within some 600 ft. of strata tested, only one, the Cochrane Seam, showed workable sections. It lies some 300 ft. below the Rob Roy Seam.

The Cochrane Seam has a total thickness averaging 9 ft. 10 in. Below some 2 ft. 5 in. of roof bands, a workable section averages 4 ft. 6½ in. This in the southern part of the area is separated from a lower 1 ft. 6 in. band of coal by 1 ft. 6 in. or less of stone.

Total measured reserves in the area of 245 acres tested have been calculated as 2,626,000 tons with average ash content of 31.1 per cent. Washability tests indicate that with 21 per cent. discard, total reserves of marketable coal with ash content less than 20 per cent. amount to 2,075,000 tons.

The washed coal has medium coking properties.

Additional reserves may lie at greater depth to the east and south-east of the area drilled.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD
PART 13—COONEANA ESTATE MINE AREA

Introduction

The Cooneana Estate area lies immediately north of the Redbank Plains Road approximately 1 mile east of Blackstone and 1½ miles south-south-east of Bundamba Railway Station.

During the latter half of 1954, borehole N.S. 93 was drilled on a site approximately 16 chains north-east of Cooneana House (B. W. Hawkins, 2). This borehole started in the Cooneana "Stage" and a coal seam was penetrated at approximately 140 ft. Because of poor recovery in the lower section of the seam, it was difficult to determine its overall quality. Further shallow drilling was recommended to delineate any area of workable coal that might exist. The shallow drilling programme carried out in the Cooneana Estate area is the result of that recommendation.

One diamond drilling plant, the Mines Department Joy-Sullivan 37, was used for the entire drilling period from 22nd January to 22nd August, 1957.

Fifteen boreholes, including one redrill, numbered N.S. 155–157, 159–161, 163–167, 169–171 inclusive, and N.S. 173 were drilled. They varied in depth from 128 ft. 8 in. (N.S. 159) to 844 ft. 11 in. (N.S. 173) and aggregated 4,517 ft. 9 in.

Because previous experience had shown that seams in the Cooneana "Stage" were not workable over large areas, earlier boreholes in the programme were designed on a 10 chain grid system. As the seam being investigated was found to persist, later boreholes were sited on a 20 chain grid system.

Sections of the coal seam recovered by diamond drilling were inspected by Engineer Members of the Coal Board before sampling. The exposure of the seam in Bob Jones' Shaft was also sampled.

The report is accompanied by the following plans and sections:—

Fig. 1.—A plan showing surface geology, topography, boresites, mine workings and areas in which reserves have been calculated.

Fig. 2.—Three cross sections.

Fig. 3.—A plan showing structure contours on the Cochrane Seam.

Figs. 4 and 5.—Generalised bore sections.

Fig. 6.—Detailed sections of seams from boreholes showing recoveries and analytical data.

Geology

A. K. Denmead (1) has divided the Ipswich "Series" into four "stages" of which only two, the Blackstone and Cooneana "Stages," are represented in this area.

Blackstone "Stage"

The Blackstone "Stage" outcrops only on the eastern margin of the area. It is typified by interbedded shales and siltstones with some sandstone beds and three named coal seams.

Only the bottom 200 ft. of the "stage" was represented in the boreholes.

Cooneana "Stage"

The full thickness of the Cooneana "Stage" was not drilled in any of the boreholes. However, on the eastern margin of the drilled area at least 600 ft. of the "stage" was penetrated.

The Rob Roy Seam is invariably underlain by a shale-siltstone member averaging 10 ft. in thickness. This is followed by a fine sandstone, often with coarse beds. Below this sandstone is a small lenticular coal seam. This seam is followed by a coarse sandstone, often pebbly, averaging 120 ft. in thickness. This sandstone outcrops as a continuous strip in the east and south-east parts of the area. Underlying this sandstone is another small lenticular coal seam which outcrops in the railway cutting at the Redbank Plains Road overbridge. It also outcrops approximately 4 chains west of N.S. 164. This seam is followed by a shale which is often interbedded with siltstone and sometimes a fine sandstone. The shale averages 150 ft. in thickness. It covers most of the central area of Cooneana Estate and has weathered to a red-brown clayey soil. Limestone nodules are sometimes present. Underlying this shale is a coal seam which lies some 300 ft. below the pavement of the Rob Roy Seam. This coal seam has been named the Cochrane Seam after the late Mr. D. W. Cochrane, a former director of Rhondda Collieries. Below the Cochrane Seam lies approximately 300 ft. of fine and coarse sandstone with some shale beds and four unnamed coal seams.

Structural Geology

The dominant structural feature of the area is the Bundamba Anticline. There are two dome structures along the line of the anticline and the Cooneana Estate Mine Area covers most of the southern portion of the northern dome.

The structure is slightly asymmetrical. Dips on the eastern flank measure approximately 10 deg. while those on the western flank vary up to 20 deg.

The axis of the fold is difficult to locate. It must lie to the west of Jones' Shaft and appears to lie very close to N.S. 171. N.S. 170 is on the western flank of the structure.

Few faults are evident on the surface owing to the scarcity of outcrops. Some major faults are known from mine workings.

The Noblevale fault, a reverse fault striking west-north-west along a line parallel to and just north of the Redbank Plains Road, is known only from mine workings (A. K. Denmead, 1). In the south-eastern corner of the area are workings on the Four Feet Seam (Noblevale No. 1). A study of the mine plans indicates that the vertical displacement of the fault diminishes to the west-north-west.

The extent of the fault dipping at 40 deg. to the east-south-east which stopped development in Noblevale No. 1, No. 3 Tunnel is not known. This fault may extend to the north-west and have some effect on the mining of the Cochrane Seam. No other fault present in the mine workings would have any serious effect.

The Coal Seams

Three named seams in the Blackstone "Stage" are represented in the area as well as several seams in the Cooneana "Stage." Of these Cooneana "Stage" seams, only one, the Cochrane Seam, is workable.

The seams in descending order are:—

(i.) Blackstone "Stage"—
- Bergin.
- Striped Bacon.
- Rob Roy.

(ii.) Cooneana "Stage"—
- Two unnamed seams.
- Cochrane.
- Several small unnamed seams.

(i.) Blackstone "Stage"

Bergin Seam

This seam was penetrated in only one borehole, N.S. 173, at a depth of 17 ft.

Striped Bacon Seam

This seam was penetrated in boreholes N.S. 163 and N.S. 173. The sections each measured approximately 6 ft. in thickness.

Rob Roy Seam

This seam was penetrated in boreholes N.S. 163, 165, 167, and 173. In both N.S. 163 and N.S. 165, the seam section measured 8 ft. in thickness while that in N.S. 173 measured 4 ft. 6 in. The seam in N.S. 167 was split into two sections. The 7 ft. top section was separated from the 9 ft. 6 in. bottom section by 6 ft. of shale. The seam is also split in Rhondda No. 1 Mine workings which are 4 to 5 chains east of this borehole.

(ii.) Cooneana "Stage"

Upper Seams

A small lenticular seam was penetrated some 30–50 ft. below the Rob Roy Seam in boreholes N.S. 163, 165, 167, and 173. The seam section generally measures 3 to 4 ft. in thickness and consists of thin bands of coal and shale. In N.S. 165, the seam was 11 ft. thick but contained no workable section. This seam is nowhere workable in the area.

Approximately 130 ft. below the above seam, another small lenticular seam was penetrated in the majority of the boreholes. This seam varies in thickness from 1 ft. to 9 ft. and consists of thin coal and shale bands with no workable section.

Cochrane Seam

This seam was penetrated in all but one (N.S. 170) of the boreholes in the area. It lies some 300 ft. below the floor of the Rob Roy Seam.

Generally the seam section varies from 9 ft. to 11 ft. in thickness with an average thickness of 9 ft. 10 in. The seam may be divided into four sections.

Borehole N.S.	To Bottom of Fawn Shale Marker	Marker to "Split"	"Split"	Bottom Section
	Ft. in.	Ft. in.	Ft. in.	Ft. in.
155	2 2	4 5	0 10½	1 6
156	2 1	4 5¼	1 3½	1 5½
157	2 3¾	4 7	1 2	1 8
159	2 4	4 7½	1 0½	1 7½
160	2 4¼	5 1¼	0 11	1 7¼
161	2 4¾	4 9¼	1 8	1 2¼
163	2 10½	5 4½	1 6¾	1 5¾
164	2 4½	4 2¼	1 9¼	1 2¾
165	2 6	4 3	1 8	1 1¼
167	2 4¾	4 2¼	2 1¾	1 1¼
169	3 2¼	4 0	2 8¼	1 8
173	1 5¾	5 2	1 5½	1 3¼
93	1 6½	4 0½	1 4½	1 6
Jones' Shaft ..	2 10	3 11½	1 2	1 6½

(*a*) This section, from the roof to the bottom of the fawn shale marker band, is a strongly banded one. It averages 2 ft. 5 in. in thickness and ranges from 1 ft. 5¾ in. (N.S. 173) to 3 ft. 2¼ in. (N.S. 169).

(*b*) Below this marker band is a workable section of coal containing only a few shale bands. It has an average thickness of 4 ft. 6½ in. ranging from 3 ft. 11½ in. (Jones' Shaft) to 5 ft. 4½ in. (N.S. 163).

(*c*) the "split" is usually composed of siltstone which grades into fine sandstone in some boreholes.

The "split" in N.S. 155 is 10½ in. thick. To the south and west of this borehole it increases to approximately 18 in. To the north it increases to a maximum of 2 ft. 8¼ in. in N.S. 169 and to the north-east to a thickness of 2 ft. 1¾ in. in N.S. 167. To the east and south-east it increases to a thickness of 1 ft. 6 in.

(*d*) The *bottom section* consists of coal with a few shale bands. Sometimes a small band of "boulder" occurs at the bottom of this section.

To the south, south-east and west of N.S. 155, the bottom section is approximately 1 ft. 6 in. thick. To the north, this section deteriorates in quality and decreases in thickness.

Lower Seams

Several small seams were penetrated in borehole N.S. 173 but generally these seams were of no interest. A 14 ft. seam was cored at 765 ft. but it was strongly banded and contained no workable section.

Washability Tests

Coal samples from the Cochrane Seam had an average ash content slightly in excess of 31 per cent. Therefore washability tests were carried out on all samples.

TABLE I

WASHABILITY TEST PERCENTAGES —COCHRANE SEAM

Bore No.	NS 155	NS 156	NS 157	NS 159	NS 160	NS 161	NS 163	NS 164	NS 165*	NS 167*	NS 169*	NS 173	NS 93†	Jones' Shaft
Sample No.	237/57	238/57	239/57	240/57	241/57	367/57	520/57	521/57	601/57	603/57	807/57	800/57	726/57	300/57
Ash on original sample	32·1	26·1	33·3	31·6	30·0	28·1	29·5	32·9	28·5	34·5	38·1	32·6	30·0	35·5
Floats at 1.4 sp. gr. ..	45·1	54·0	55·3	60·8	55·9	53·6	51·4	41·9	58·9	47·3	48·4	49·6	54·5	51·3
Ash	10·6	12·5	12·0	12·0	12·8	10·8	10·3	10·5	10·6	11·9	12·0	12·8	9·6	13·0
Floats at 1.6 sp. gr. ..	24·3	20·6	16·1	12·6	12·4	24·4	24·3	25·8	11·4	27·1	13·2	13·1	9·1	17·5
Ash	26·3	27·4	28·2	27·9	27·9	26·2	26·9	26·6	25·6	25·2	26·7	28·8	24·9	32·8
Floats at 1·8 sp. gr. ..	6·0	5·7	8·3	6·6	10·8	8·1	6·7	5·3	6·7	7·1	7·4	11·8	11·6	7·9
Ash	47·2	43·5	39·1	40·6	54·6	55·8	44·9	41·8	38·6	49·2	38·6	40·4	37·5	49·1
Sinks at 1·8 sp. gr. ..	24·6	19·7	20·3	20·0	20·9	13·9	17·6	27·0	23·0	18·5	31·0	25·5	24·9	23·3
Ash	70·9	71·7	75·5	71·0	74·7	75·7	74·9	75·9	75·7	76·7	75·8	74·5	73·6	69·4

* Top section of seam only.

† Only 76 per cent. recovery in seam (54 per cent. loss over bottom 2 feet 3 inches). Section includes some coal above the fawn shale band used to mark the top of the workable section in other bore holes.

Description of Coal

The average fixed carbon content of the washed coal from the Cochrane Seam, calculated on a dry mineral-matter-free basis, is 64·6 per cent. The values from fourteen samples range from 61·7 per cent. to 67·9 per cent. placing the coal in the high volatile bituminous group.

The moisture content of the washed coal shows little variation and averages 1·8 per cent. The sulphur values, which range from 0·31 per cent. to 0·43 per cent., average 0·36 per cent. These values are similar to those obtained elsewhere in the Ipswich Coalfield.

The calorific value of washed coal carrying 20 per cent. ash is approximately 11,550 B.T.U.'s per lb.

Coking tests were carried out on all washed samples. (See Table II.) These showed that the coal has medium coking properties with an average swelling index in the range 3½ to 4. Low values were obtained in coking tests carried out on coal samples from N.S. 93 and from Jones' Shaft. N.S. 93 was drilled in 1954 and the coking test was carried out on a duplicate sample which had been stored for three years. This would probably account for the low swelling index value. In Jones' Shaft the seam is only 40 ft. below the surface and weathering would explain the poor coking properties of this sample.

TABLE II

COKING TESTS—COCHRANE SEAM

Bore No.	Sample No.	Classification.	Swelling Index
N.S. 155	237/57	Cm.	3½
N.S. 156	238/57	Cm.	4
N.S. 157	239/57	Cm.	3½
N.S. 159	240/57	Cm.	4½
N.S. 160	241/57	Cm.	4
N.S. 161	367/57	Cm.	4
N.S. 163	520/57	Cm.	4
N.S. 164	521/57	Cm.	3½
N.S. 165	601/57	Cm.	3
N.S. 167	603/57	Cw./Cm.	3
N.S. 169	807/57	Cw.	3½
N.S. 173	800/57	Cw.	3
N.S. 93	726/57	Cw.	2
Jones' Shaft ..	300/57	Af.	..

Coal Reserves

In calculating reserves, an arbitrary limit of five chains beyond an outer borehole has been placed on the extent of workable coal. The unavailability of coal due to any possible faulting has been disregarded and no allowance has been made for loss in mining.

Measured reserves exist in the Cochrane Seam only and have been calculated in two areas:—

(i.) Area A in which both the top and bottom sections of the seam are workable.

(ii.) Area B in which the top section only is workable.

(i.) In area A measured reserves exist over an area of 185·1 acres. The average thickness of workable coal is 6 ft. 1 in. for which the weighted average ash content is 31·1 per cent. with a corresponding specific gravity of 1·561. Reserves have been calculated as 2,134,000 tons.

Washability tests on the above coal have indicated that, in a medium of specific gravity 1·8 and with a discard of 21·03 per cent., a marketable coal can be produced with an average weighted ash content of 18·6 per cent. and with a specific gravity of 1·423. Reserves of marketable coal in this category have been calculated at 1,685,000 tons.

(ii.) In area B measured reserves exist over an area of 60 acres. The average thickness of workable coal is 4 ft. 2½ in. for which the average weighted ash content is 32·26 per cent. with a corresponding estimated specific gravity of 1·605. Reserves have been calculated at 492,000 tons.

Washability tests on the above coal have indicated that, in a medium of specific gravity 1·8 and with a discard of 20·7 per cent., a marketable coal can be produced with an average weighted ash content of 20·57 per cent. and with a specific gravity of 1·429. Reserves of marketable coal in this category have been calculated at 390,000 tons.

Hence total reserves of marketable coal in both areas amount to 2,075,000 tons.

If only the top section of the seam is worked in both areas A and B, it is estimated that at least 1,500,000 tons of marketable coal is available.

Conclusion

Diamond drilling in the area has proved 2,626,000 tons of coal in the Cochrane Seam. This has an ash content greater than 30 per cent. and, by washing, 2,075,000 tons of marketable coal could be produced. The washed coal has medium coking properties.

Additional reserves may lie at greater depth to the east and south-east of the area drilled.

References

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HAWKINS, B. W., 1956. Ipswich Borehole N.S. 93 Cooneana Estate. *Q'land. Govt. Min. Journ.*, March, 1956.

HAWKINS, B. W., 1958. Coal Reserves, West Moreton (Ipswich) Coalfield; Part 8 P.D.T.S. Nos. 9 and 10 Mine Areas, Blackheath-Bonnie Dundee. *Geol. Surv. Qland* Pub. No. 288.

S. G. REID, Government Printer, Brisbane.

FIG.1

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF COONEANA ESTATE MINE AREA IPSWICH COALFIELD

Parish of Goodna
County of Stanley

Showing Surface Geology, Topography, Boreholes, Mine Workings and Reserves

To accompany report by D.C.Mengel B.Sc.
Topographic Survey by E.Cowley

Scale of Chains

5 4 3 2 1 0 5 10 15 20

Grid of 20 chn. co-ordinates. Meridian of grid is True North at origin, an arbitrary point, being bolt in concrete block on road near angle in Eastern boundary of Sub.1, Pon 213, Parish of Ipswich. Elevations on State Datum.

LEGEND

Established geological boundary — position accurate
" " " approx.
Inferred, probable or indefinite boundary
Established fault — position accurate
" " " approx.
" " " concealed
Inferred, probable or indefinite fault
" " " " concealed

Alluvium
Ipswich Coal Measures
Blackstone Stage
Cooneana Stage

Coal seam at surface
Outcrop
Strike and dip of strata, fault.
Section line
Surface Contours
Colliery Working
Colliery Abandoned
Adit
Shaft
Diamond drillhole
Limit of Mine Workings :-
Four Feet Seam
Bergin Seam
Striped Bacon Seam
Rob Roy Seam
Boundary of Measured Reserves :-
Cochrane Seam Full Section
" " Top Section

NOBLEVALE No1
NOBLEVALE No1 A

N.J.Hunt del.

LOCALITY MAP

SCALE OF MILES

2½ 2 1½ 1 ½ 0 2½

200W 00 200E 400E

400N

200N

00

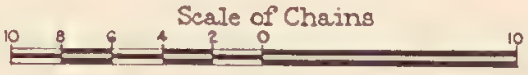
200S

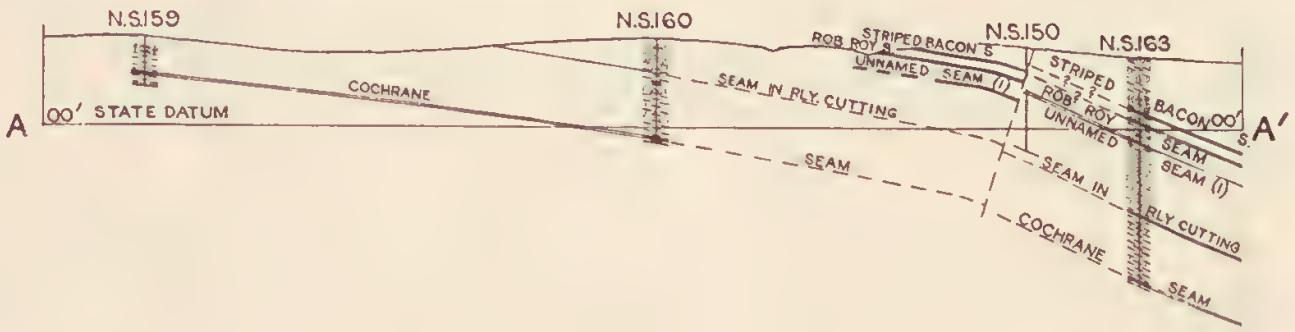
HAIGHMOOR AREA
WESTFALEN AREA
ABERMAIN AREA
R.HAIGH AREA
MORETON EXT. AREA
Dinmore
Riverview
Redbank
Ebbw Vale
Bundamba
Booval
IPSWICH
East Ipswich
BUNDAMBA AREA
NEW WHITWOOD AREA
NEW ABERDARE EAST AREA
COONEANA ESTATE AREA
BLACKHEATH
BONNIE DUNDEE AREA
SWANBANK LAGOON AREA
SOUTHERN CROSS AREA
NEW HOPE AREA
BRISBANE RIVER
Brisbane River

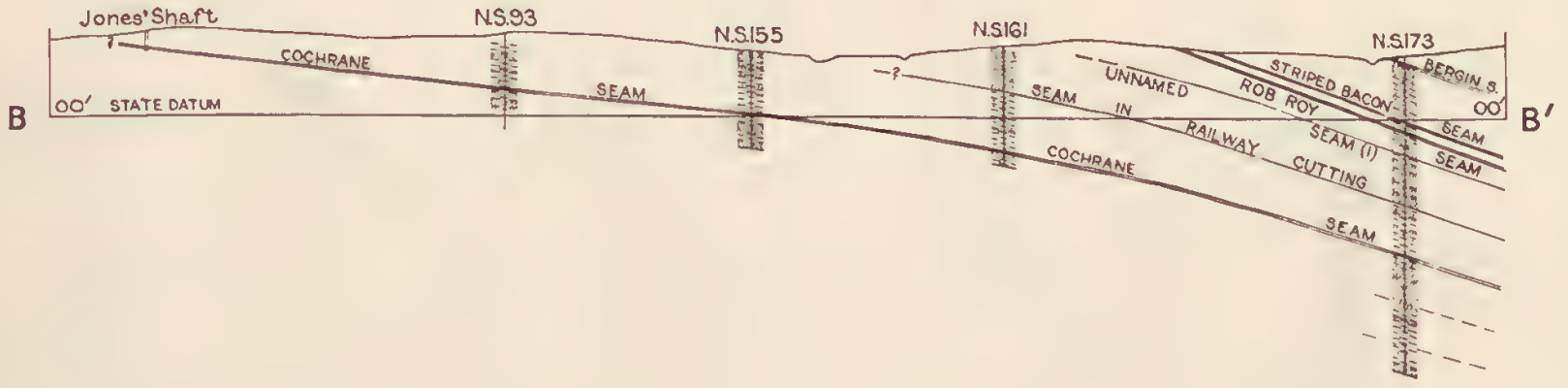
FIG.2

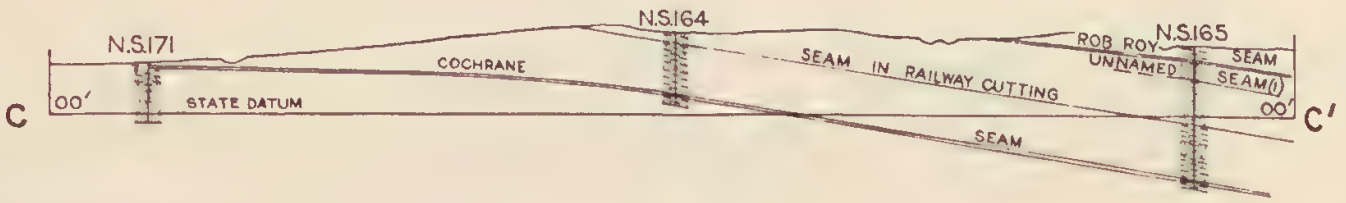
COONEANA ESTATE MINE AREA
CROSS SECTIONS

Scale of Chains









N.J.H. 14-9-58

COONEANA ESTATE MINE AREA

SKELETON PLAN

SHOWING

STRUCTURE CONTOURS

COCHRANE SEAM

To accompany report by D.C.Mengel B.Sc. Geologist

SCALE OF CHAINS

10 8 6 4 2 0 10

NB Contours drawn on base of seam at 50' intervals

All levels referred to State Datum

LEGEND

Fault — — — —

Colliery NOBLEVALE

Structure Contour .—100—

Diamond drillhole ◎

N.J.Hunt del.

241

248

249

250

277

276

251

291

296

283

278

279

280

JONES' No.1

JONES' SHAFT

PALMER'S SHAFT

BRIGENSHAW'S ADIT

BROWN'S SHAFT

NOBLEVALE A BERGIN'S TNL

LOOP LINE

NOBLEVALE No.1 A No.4 TNL

NOBLEVALE No.1 A No.5 TNL

NOBLEVALE No.1 A No.1 TNL

NOBLEVALE No.1 A No.2 TNL

NOBLEVALE No.1 A No.3 TNL

BUNDAMBA

REDBANK

N.S.170
R.L.Coll. 88·50
R.L. Surf. 87·45
R.L.Btm.–337·66

N.S.169
R.L.Coll. 152·30
R.L.Surf. 151·23
R.L. Btm. 25·62

N.S.166
R.L.Coll. 277·60
R.L. Surf. 276·55
R.L Btm. 239·10

N.S.167
R.L Coll. 268·80
R.L Surf. 267·80
R.L.Btm.–58·20

N.S.171
R.L.Coll. 137·70
R.L Surf. 136 80
R.L.Btm. 19·71

N.S.164
R.L.Coll. 213·00
R.L.Surf. 211·75
R.L Btm. 21·75

N.S.165
R.L.Coll. 184·70
R.L. Surf. 183·58
R.L. Btm.–186 13

N.S.156
R.L Coll. 167·30
R.L.Surf. 166·11
R.L.Btm.–68·20

N.S. 93
R.L.Coll. 225·90
R.L Surf. 221 36
R.L Btm.–2534·10

N.S.155
R.L Coll 178·75
R.L. Surf. 177 50
R.L Btm.–82·75

N.S.161
R.L.Coll. 192·75
R.L Surf 191·50
R.L Btm–128 00

N.S.173
R.L.Coll. 167·32
R.L.Surf. 167·07
R.L Btm.–667·60

N.S.157
R.L.Coll. 175·85
R.L.Surf. 174·60
R.L. Btm. 5·68

N.S.149
R.L.Coll. 208·20
R.L. Surf. 207 50
R.L. Btm. 58·30

N.S.159
R.L Coll. 230 00
R.L. Surf. 229 80
R.L Btm. 101·33

N.S.160
R.L Coll. 233·12
R.L Surf 232 05
R.L Btm.–39·63

N.S.163
R.L Coll. 192·68
R.L. Surf. 191·88
R.L. Btm.–401·99

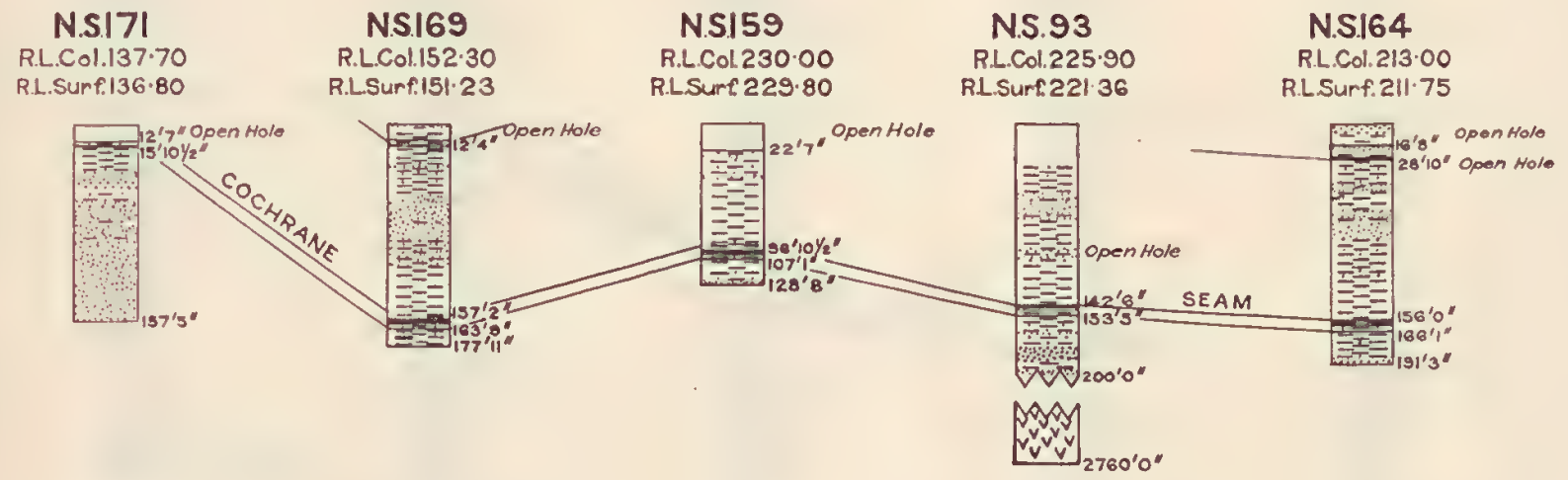
N.S.150
R.L.Coll. 215·55
R.L. Surf. 214·25
R.L Btm.–56·95

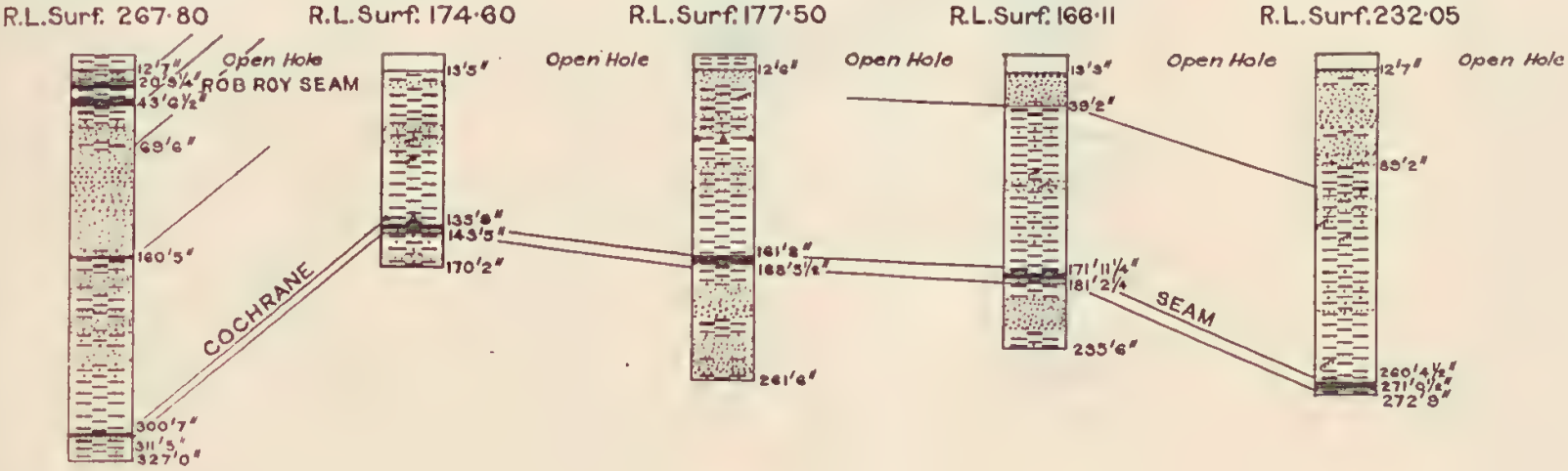
N.S.82
R.L.Coll. 142·11
R.L. Surf 140·28
R.L. Btm.–286·39

COONEANA ESTATE MINE AREA GENERALISED BORE SECTIONS

Geological Survey of Queensland Publication No. 293

FIG. 4





Scale of Feet

100 50 0 100 200 800

LEGEND

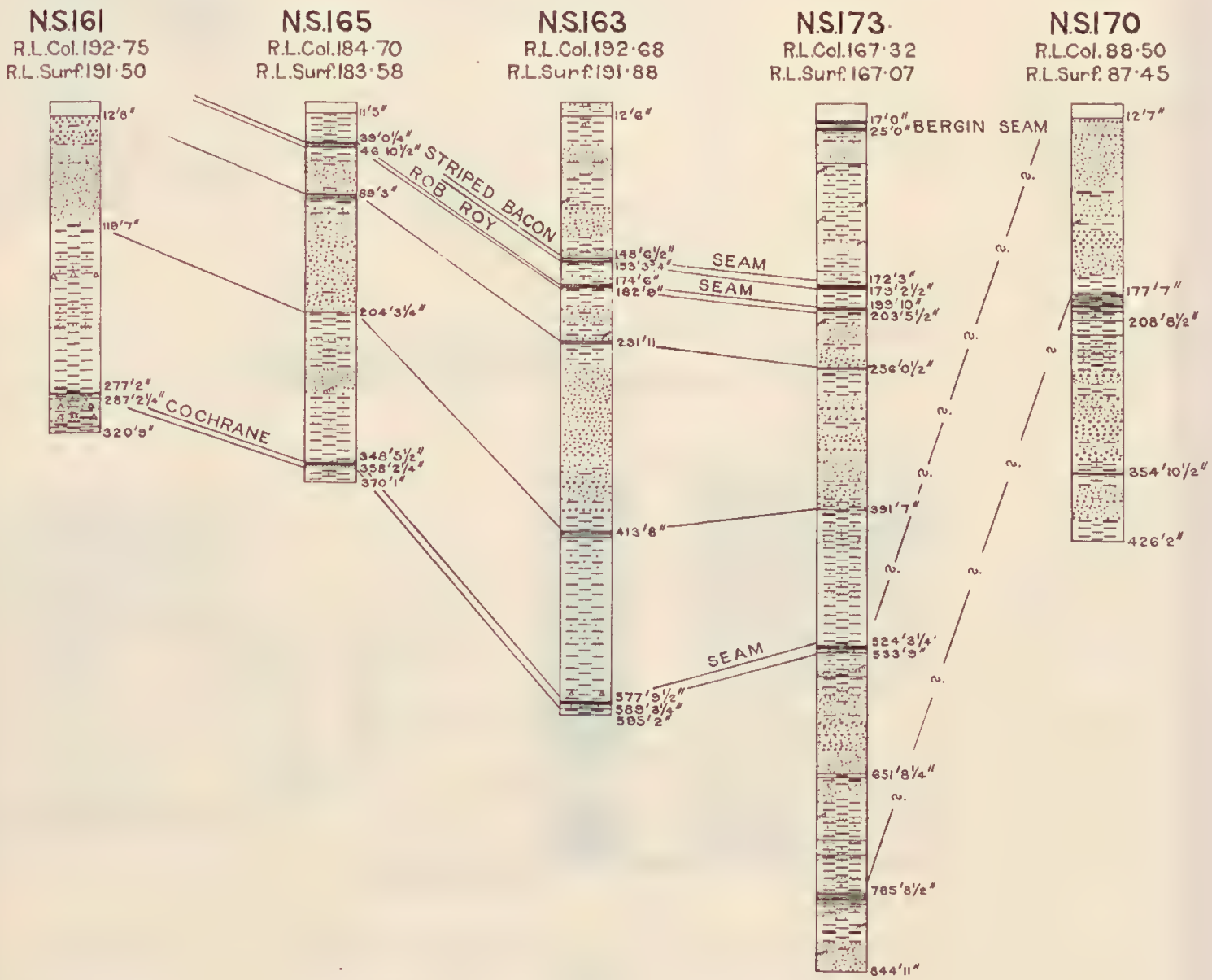
Alluvium		Pebbly sandstone	
Mudstone }		Coal with sh. bands	
Claystone }		Coal	
Shale		Iron Carbonate	
Siltstone		Volcanic Rocks	
Sandstone		Fault Zone	

N.J.H. 27.8.58.

COONEANA ESTATE MINE AREA GENERALISED BORE SECTIONS

– Geological Survey of Queensland Publication No. 293

FIG.5



Scale of Feet

100 50 0 100 200 300

LEGEND

Alluvium		Pebbly sandstone	
Mudstone }		Coal with sh. bands	
Claystone }		Coal	
Shale		Iron Carbonate	
Siltstone		Basaltic Sill	
Sandstone		Fault Zone	

N.J.H. 28.8.58.

FIG.6

COONEANA ESTATE MINE AREA
IPSWICH
DETAILS OF CORE RECOVERY & ANALYSIS
DIAGRAMS OF COCHRANE SEAM

To accompany report by D.C.Mengel B.Sc.
N.J.H. 21.8.58

Prox Analysis Recovery Section — Washability etc. per cent sampled | Section JONES' SHAFT | Description

A% 35·5 S.G. 1·61 W ×

Prox. anal. on comp. of floats
M.% 2·4 V.M.% 27·1 F.C.% 49·2 A% 21·3 S% 0·34 Joules/Gm. 25690 B.T.U./lb. 11050 S.G. 1·47 Coking test Class Af S.I. —

Excluded

300/57

med. gy. sh.

½" fwn. sh. 7" med. gy. sh.

1" fwn. sh. 5" med. gy. sh.

40'7¼" 7" coal and inf. coal with ½" sh. at 2" and 4" ½" fwn. sh 1" coal 1" fwn. sh. 2" coal ½" fwn. sh 2½" coal 3½" fwn. sh.

9" coal and inf. coal ½" med. gy. sh. 1½" inf. coal

43'5½" 1" med. gy. sh. 2" dk. gy. sh. → carb. sh. 2" fwn. sh. 2" inf. coal 1" med. gy. sh. 3½" coal and inf. coal 1" carb. sh. 2½" inf. coal 5⅛" coal 1" fwn. sh.

1'4" coal and inf. coal with ¼" sh. at 8" and 10⅛"

1" med. gy. sh.

8" coal with ¾" fwn. sh. at 2"

47'5" ½" med. gy. sh. 5½" coal

1'2" l. gy. slts.

48'7" 1½" coal 1" med. gy. sh. 2½" coal ⅛" lens med. gy. sh. 1" coal 1½" l. gy. sh. 1" coal ½" lens. med. gy.

50'1¼" sh. 5" coal ½" med. gy. sh.

50'8½" 4½" coal and inf. coal 2⅛" carb. sh. 2½" med. gy. sh. 2" inf. coal

med. gy. sh.

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.93 | Description

A% 30·0 S.G. 1·57 W ×

Prox. Anal. on Comp. of Floats
M.% 1·8 V.M.% 29·3 F.C.% 53·2 A% 15·7 73·1 726/57 S% 0·40 Joules/Gm 28100 B.T.U./lb. 12090 S.G. 1·40 Coking test Class. Cw S.I. 2

Overall Recovery 79·2% — 142'6" – 153'1¼"

142'6" 1⅞" (p.b.c) coal ¾" med. gy. sh. 2" (p.b.c.) coal 1⅛" coal and inf. coal ⅛" (p.b.c.) coal and med. gy. sh. 1¾" coal and inf. coal ⅜" dk. gy. sh. 4" 3¼" coal with ¾" dk. gy. sh. 4" 3¼" 1" fwn. sh. ¾" bluey 9½" (p.b.c.) coal ½" fwn. sh. ¼" carb. sh. 5¾" (p.b.c.) coal 1" fwn. sh. 2½" coal

10⁴ (p.b.c) coal with ⅛" sh. at 2¼"

148'1½" 1" dk. gy. slts.

1'2⅝" l. gy. slts. ¼" dk. gy. sh. ¾" coal 2" (p.b.c.) coal and med. gy. sh. 3½" coal 1" dk. gy. sh. 2¾" (p.b.c.) coal ¼" med. gy. sh. 3" coal 1⅛" boulder 1" carb. sh. 1⅛" dk. gy. sh.

151'9¼" 6¾" carb. sh.

1'4" dk. gy. sh.

153'1½"

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.155 | Description

A% 32·1 S.G. 1·57 W ×

Prox Anal on Comp. of Floats
M.% 1·7 V.M.% 29·0 F.C.% 50·6 A% 18·7 98·6 237/57 S% 0·34 Joules/Gm. 27200 B.T.U./lb. 11700 S.G. 1·43 Coking test Class Cm S.I. 3·5

Excluded

Overall Recovery 98·9% — 159'2" – 168'11½"

159'2" 4" (p.b.c) dk. gy. sh. 7¼" (p.b.c.) inf. coal → coal ½" fwn. sh. 1" bluey ½" fwn. sh. 1¾" inf. coal 2" fwn. sh. 1" coal 1" carb. sh. 2½" coal ½" carb. sh. 2" fwn. sh. 1" carb. sh. 1½" coal 2" carb. sh. 2" fwn. sh. 1½" coal ½" carb. sh. 3½" coal 1⅛" med. gy. sh.

161'8" 1⅝" fwn. sh. 2" coal 11" coal 2" carb. sh. 2¼" coal ½" fwn. sh. 1½" coal ½" carb. sh. 3½" coal 1⅛" med. gy. sh.

1'6" coal with sh. lam. at 10"

166'1" ¾" fwn. sh. 2¼" coal ¼" med. gy. sh. 3" coal with few sh. lam. 5½" l. gy. slts.

166'1½" 4" l. gy. ss. 1" dk. gy. sh. ½" carb. sh. 1½" coal 1" dk. gy. sh. 3½" coal ¾" dk. gy. sh. 3" (p.b.c.) coal 1" bluey ½" coal 1" med. gy. sh. 3¼" coal

168'5⅛" with sh. lam. at 2" 1" coal y sh.

168'11½"6" dk. gy. sh. with FeCO₃ nodules

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.156 | Description

A% 26·1 S.G. 1·51 W ×

Prox. Anal. on Comp. of Floats
M.% 1·6 V.M.% 26·7 F.C.% 53·0 A% 18·7 92·2 238/57 S% 0·33 Joules/Gm. 27230 B.T.U./lb. 11710 S.G. 1·43 Coking test Class Cm. S.I. 4

Excluded

Overall Recovery 93·9% — 171'11¼" – 181'2½"

171'11¼" ¾" (p.b.c) inf. coal ⅛" carb. sh. 4½" (p.b.c) coal ½" fwn. sh. ¼" carb. sh. ⅛" fwn. sh. ½" inf. coal ¾" bnn. sh. 1½" bluey ¾" coal 2½" bnn. sh. 3¼" bluey 2½" 8" bnn. sh. 1¾" coal ½" bnn. sh. ¾" (p.b.c) carb. sh. 1⅛" (p.b.c) inf. coal 1" ¾" fwn. sh. 11 (p.b.c) coal ¾" med. gy. sh. 4" coal ⅛" carb. sh. 4¼" (p.b.c) coal → inf. coal ¾" dk. gy. sh. ⅛" carb. sh.

174'2⅛" 13¾" (p.b.c) coal → inf. in places ½" dk. gy. sh.

11½" (p.b.c) coal

178'5⅛" 1'0½" med. gy. slts.

179'8" ½" med. gy. sh. 1" inf. coal 1⅛" dk. gy. sh. 5¼" (p.b.c) coal 1" med. gy. sh. 3¼" (b.c.) coal

181'2⅛"

N.S.157

131'8"

11½" (p.b.c) brec. and fract. med. gy. sh.

133'5¼" 1" l. gy. sh. 6¾" med. gy. sh.

2⅛" (p.b.c.) inf. coal 2¾" coal ¾" carb. sh. 1" fwn. sh. 1⅞" bluey ½" fwn. sh. 1¼" carb. sh. 2" (p.b.c.) coal 2¼" fwn. sh. 4¾" inf. coal ¾" bnn. sh. 2¼" inf. coal → coal

135'9" 2¼" carb. sh. 1" inf. coal 1½" dk. gy. sh. 1½" fwn. sh. ¾" carb. sh.

8¼" (p.b.c) coal → inf. coal ¾" med. gy. sh. 1¾" (b.c) coal ½" med. gy. sh. 2¾" inf. coal ¾" bnn. sh. 3⅛" (b.c) coal 1" bnn. sh.

9¾" coal ¼" med. gy. sh. 1¼" inf. coal

140'4" 8¼" l. gy. slts. with FeCO₃ in top ¾" 5¼" med. gy. slts. 1" (b.c.) coal ½" med. gy. sh. 4½" (p.b.c.) coal and inf. coal ½" l. gy. sh. 4½" (p.b.c.) coal 1" (b.c.) inf. coal and inf. coal ½" l. gy. sh. 4½" (p.b.c.) coal and inf. coal ½" l. gy. sh. 4½" (p.b.c.) coal

141'6"

143'2" carb. sh. 1¼" dk. gy. sh. 3¾" coal

143'6" 3" boulder 6⅛" dk. gy. sh. → carb. sh. 3½" med. gy. sh.

144'3"

Overall Recovery 94·4% — 133'5¼" – 143'5"

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.159 | Description

A% 31·6 S.G. 1·56 W. ×

Prox. Anal. on Comp. of Floats
M.% 1·8 V.M.% 30·0 F.C.% 51·3 A% 16·9 97·7 240/57 S% 0·36 Joules/gm. 28090 B.T.U./lb. 12080 S.G. 1·41 Coking test Class. Cm. S.I. 4·5

Excluded

Overall Recovery 96·3% — 36'10½" – 107'1"

86'10½" 4" (b.c) coal 2" med. gy. sh. with FeCO₃ in top ¾" 1¼" fwn. sh. 3" (p.b.c) inf. coal 2¼" fwn. sh. 5" (p.b.c) coal → inf. ½" carb. sh. 2" fwn. sh. 1" (b.c.) carb. sh. 2¼" fwn. sh. ½" coal ¼" carb. sh. 2½" med. gy. sh. 2" (p.b.c) coal 7" (b.c) coal

99'2½" sh. ½" dk. brn. sh. 1¼" inf. coal 2¾" fwn. sh. 9½" (p.b.c) coal ½" med. gy. sh. 2" (p.b.c) coal 7" (b.c) coal

½" med. gy. sh. 1¼" inf. coal → carb. sh. 6¾" coal with ¼" sh. lam. at 2½" ¾" med. gy. sh. ½" (p.b.c) coal ½" med. gy. sh.

8½" (p.b.c) coal ½" med. gy. sh.

103'10" 1'2" (p.b.c) coal with sh. lam. at 2¼" and 1⅛" from top

104'10¾" 1⅛" (b.c.) coal and inf. coal 1" dk. gy. sh. 3¾" (p.b.c) coal ¾" fwn. sh. 9¼" (b.c.) coal ½" med. gy. sh.

106'6" 2¾" (b.c.) coal 5" boulder

107'1" 2" (p.b.c.) coal

1'0½" l → med. gy. slts.

148'1½" 1" dk. gy. slts.

1'2⅛" l. gy. slts. ¼" dk. gy. sh. ¾" coal 2" (b.c.) coal and med. gy. sh. 3½" coal 1" dk. gy. sh. 2¾" (p.b.c.) coal ¼" med. gy. sh. 3" coal 1⅛" boulder 1" carb. sh. 1⅛" dk. gy. sh.

151'9¼" 6¾" carb. sh.

1'4" dk. gy. sh.

153'1½"

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.160 | Description

A% 30·0 S.G. 1·55 W ×

Prox Anal on Comp. of Floats
M.% 1·7 V.M.% 29·0 F.C.% 48·1 A% 21·2 91·8 241/57 S.% 0·34 Joules/Gm. 26590 B.T.U./lb. 11440 S.G. 1·43 Coking test Class Cm S.I. 4

Excluded

Overall Recovery 90·4% — 260'4½" – 271'0½"

260'4½" 2½" (b.c.) coal ⅛" fwn. sh. 3" (b.c.) inf. coal ⅛" dk. gy. sh. 2¼" fwn. sh. 1" carb. sh. 3" inf. coal 1¼" carb. sh. 2⅛" bnn. sh. ½" carb. sh. ¼" med. gy. sh. 2" fwn. sh. ½" coal ¼" carb. sh. 1¼" coal ¾" carb. sh. 5¾" coal ¾" med. gy. sh. 3½" coal ¼" carb. sh. 2" fwn. sh. ½" coal ¼" carb. sh. 5¾" coal ¾" med. gy. sh. 2½" coal ¼" carb. sh 1" med. gy. sh. 3¼" (p.b.c) coal ⅛" carb. sh. 1¼" coal 1" carb. sh. 1" fwn. sh. 1¼" coal ½" carb. sh. 3¼" coal ⅛" med. gy. sh. 3¼" coal ⅛" dk. gy. sh. 6" (p.b.c) coal ¾" med. gy. sh. 3½" coal ½" med. gy. sh.

262'8¾" ¾" carb. sh. 1" (b.c.) coal 3¼" inf. coal. ½" coal ¼" carb. sh. 2" fwn. sh. ½" coal ¼" carb. sh. ¼" coal ¾" carb. sh. 5¾" coal ¾" med. gy. sh. 3½" coal ¼" carb. sh. 3¼" (p.b.c) coal and inf. coal ¼" med. gy. sh. ¾" inf. coal ⅛" med. gy. sh. 2½" coal ¼" carb. sh 1" med. gy. sh. 3¼" (p.b.c) coal ⅛" carb. sh. ¼" coal ¾" med. gy. sh. 3¾" coal ⅛" dk. gy. sh. 6" (p.b.c) coal ¾" med. gy. sh. 3½" coal ½" med. gy. sh.

267'10" 1" l → med. gy. slts.

268'9" 7¼" l. gy. ss. 2¼" med. gy. slts. ⅛" coal 1" med. gy. sh. 3½" (p.b.c) coal ½" med. gy. sh. ¼" coal 1" med. gy. sh. 3½" coal ½" med. gy. sh. 5" coal ¼" carb. sh. 1" med. gy. sh. ½" inf. coal ¾" med. gy. sh. ½" coal ½" med. gy. sh. ½" (b.c) coal

270'4¼" 1" dk. gy. sh. with FeCO₃ nodules

271'0½" ½" coal ⅛" med. gy. sh. ½" (b.c) coal

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.161 | Description

A% 28·1 S.G. 1·51 W ×

Prox Anal on Comp. of Floats
M.% 1·8 V.M.% 23·2 F.C.% 49·2 A% 19·8 97·5 367/57 S% 0·34 Joules/Gm. 27210 B.T.U./lb. 11710 S.G. 1·43 Coking test Class Cm S.I. 4

Excluded

Overall Recovery 98·1% — 277'2" – 287'2¼"

277'2" 4¾" (p.b.c) coal ¾" carb. sh. ¾" fwn. sh. 3½" inf. coal ¾" coal ½" carb. sh. 2" fwn. sh. 3¾" carb. sh. 2¾" fwn. sh. 1¾" carb. sh.

279'6¾" 4½" inf. coal ½" dk. sh. 2" fwn. sh. 4¾" inf. coal 3" coal 1" dk. gy. sh. ¾" coal

284'4" 1'4¾" l → med. gy. slts.

286'0" 3" (p.b.c) med. gy. sh. 8" (p.b.c) coal ¾" med. gy. sh.

287'2¼" 5½" (p.b.c) coal and inf. coal.

171'11¼" ¾" (b.c) inf. coal ⅛" carb. sh. 4½" (b.c) coal ½" fwn. sh. ¼" carb. sh. ⅛" fwn. sh. ½" inf. coal ¾" bnn. sh. 1½" bluey ¾" coal 2½" bnn. sh. 3¼" bluey 2½" 8" bnn. sh. 1¾" coal ½" bnn. sh. ¾" (p.b.c) carb. sh. 1⅛" (b.c) inf. coal 1" ¾" fwn. sh. 11 (p.b.c) coal ¾" med. gy. sh. 4" coal ⅛" carb. sh. 4¼" (p.b.c) coal → inf. coal ¾" dk. gy. sh. ⅛" carb. sh.

174'2⅛" 13¾" (p.b.c) coal → inf. in places ½" dk. gy. sh.

11½" (p.b.c) coal

178'5⅛" 1'0½" med. gy. slts.

179'8" ½" med. gy. sh. 1" inf. coal 1⅛" dk. gy. sh. 5¼" (p.b.c) coal 1" med. gy. sh. 3¼" (b.c.) coal

181'2⅛"

N.S.163

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.163 | Description

A% 29·5 S.G. 1·54 W ×

Prox. Anal on Comp. of Floats
M.% 1·7 V.M.% 29·9 F.C.% 50·2 A% 18·2 98·5 520/57 S% 0·39 Joules/Gm. 27690 B.T.U./lb. 11810 S.G. 1·41 Coking test Excluded Class Cm. S.I. 4

Overall Recovery 98·9% — 577'6½" – 589'3¾"

577'6½" 1¾" carb. sh. ½" bnn. sh. 2½" inf. coal → coal ½" carb. sh. ⅜" coal ⅛" bnn. sh. ½" carb. sh. 1" fwn. sh. 1¼" carb. sh. ½" dk. gy. sh. 1¾" carb. sh 1½" inf. coal 2¼" fwn. sh. 1½" carb. sh 1¾" inf. coal 3" carb. sh. 2½" fwn. sh. ½" carb. sh. ⅛" coal 1⅛" carb. sh. ½" coal and inf. coal 1" dk. gy. sh. 3¼" coal 1" fwn. sh. ¾" coal ½" med. gy. sh.

580'8" 6" inf. coal → coal 3" fwn. sh. ⅜" carb. sh. 7⅝" coal and inf. coal 1" dk. gy. sh. 3¼" coal 1" fwn. sh. ¾" coal ½" med. gy. sh.

586'0½" 6" coal with sh. lam. ½" from top 1" med. gy. sh. 1½" carb. sh. 3¼" coal ½" dk. gy. sh. 3¾" coal

1'4¾" (p.b.c) coal with ¼" sh. at 7"

½" med. gy. sh. ¾" carb. sh.

11⅝" (p.b.c) coal

587'7¼" 8¼" l. gy. slts.

8¼" med. gy. slts.

589'1" 8" med. gy. sh. 9" (b.c) coal 1¾" med. gy. sh. 7" inf. coal → coal

589'3¾" 9" med. gy. sh 1½" coal & inf. coal

N.S.164

156'0" med → dk. gy. sh.

5¾" coal ⅜" l. gy. sh. ¾" carb. sh. ¾" fwn. sh. 1¾" coal ½" carb. sh 2¼" coal 2¾" fwn. sh. 4½" inf. coal and coal 3" fwn. sh. 2¼" coal

158'4½" 2" carb. sh. 1¾" fwn. sh. ¼" (p.b.c) carb. sh. 6½" (p.b.c) coal ¾" carb. sh. 3" coal ½" dk. gy. sh. ⅜" inf. coal 1" med. gy. sh. 3⅜" coal 1¼" med. gy. sh. ¾" carb. sh. 2" coal 1¼" med. gy. sh. 6" (b.c.) coal 1¼" med. gy. sh.

8½" (p.b.c) coal ¾" med. gy. sh.

11⅛" (p.b.c.) coal

162'6¾" 11" l → med. gy. slts.

164'4" 5" l. gy. f. ss. 1¾" l. gy. slts. 1" dk. gy. → carb. sh. 1" coal 1⅛" dk. gy. sh. 4" coal ½" blk. sh. 1" coal 1¾" med. gy. sh.

165'6¾" 3⅞" (p.b.c) coal ⅛" dk. gy. sh.

166'1" 4¾" (p.b.c) coal 2" boulder ¾" med. gy. sh. with FeCO₃ nods

167'3" 1" inf. coal 1'2" med. → dk. gy. sh.

Overall Recovery 98·4% — 156'0" – 168'1"

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.165 | Description

A% 28·5 S.G. 1·54 W. ×

Prox Anal on Comp. of Floats
M.% 1·8 V.M.% 26·5 F.C.% 43·9 A% 21·8 99·5 601/57 S.% 0·37 Joules/Gm. 25660 B.T.U./lb. 11040 S.G. 1·46 Coking test Class. Cm. S.I. 3

A.% 42·2 92·5 602/57

Overall Recovery 98·1% — 348'5⅛" – 358'2½"

348'5⅛" 1¼" carb. sh. 1¼" inf. coal ⅜" carb. sh. 5" inf. coal 1" fwn. sh. 1" carb. sh. ½" fwn. sh. 2½" inf. coal 1" 4½" inf. coal 1¾" brn. sh 1" coal 1½" carb. sh. ¼" med. gy. sh. ½" inf. coal 2" carb. sh. 1" inf. coal ¾" dk. gy. sh. 1¼" fwn. sh. 7¼" coal

350'11½" ¾" med. gy. sh. 2" (p.b.c.) coal 1" med. gy. sh. 4" (p.b.c.) coal 1⅝" med. gy. sh. 2¾" coal ½" carb. sh. ¾" med. gy. sh. 2½" (p.b.c.) coal ½" med. gy. sh. 6¾" (p.b.c) coal ½" med. gy. sh.

10⅛" (p.b.c) coal ½" med. gy. sh

9" coal

355'2½" 1'4" l. gy. f. ss. → slts.

356'10½" 4" dk. gy. sh 4" coal 1" inf. coal ¾" dk. gy. sh. 1" med → dk. gy. sh. 2¾" inf. coal.

357'11¾" ½" dk. gy. sh. 1" inf. coal ½" dk. gy. sh. 3¼" (b.c.) coal ½" med. gy. sh. 1" (p.b.c.) carb. sh. with FeCO₃.

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.167 | Description

A% 34·5 S.G. 1·60 W ×

Prox Anal on Comp. of Floats
M.% 1·9 V.M.% 29·2 F.C.% 45·5 A% 19·4 93·5 603/57 S% 0·36 Joules/Gm 27090 B.T.U./lb. 11650 S.G. 1·44 Coking test Class Cw/Cm. S.I. 3

A% 44 3 100 604/57

Overall Recovery 97·3% — 300'7" – 311'5"

300'7" 3¼" inf. coal ¾" carb. sh. 1½" coal ½" (b.c.) coal & carb. sh. ½" fwn. sh. 1⅛" carb. sh. 1½" fwn. sh. ¾" inf. coal ¾" carb. sh. ¼" inf. coal 2⅞" fwn. sh. 3½" coal ¾" carb. sh. 2¼" inf. coal 2" coal 3" (p.b.c.) coal 1¼" carb. sh. 3" (b.c.) coal 1¼" bnn. sh. 1¾" (b.c) coal

302'11¾" 3" dk. brn. sh. 3½" carb. sh. 2" fwn. sh. 2¼" inf. coal 2" coal 3" (p.b.c.) coal 1" inf. coal 1" dk. gy. sh. ½" carb. sh. 3" (b.c.) coal 1¼" bnn. sh. ½" carb. sh. 3" (b.c.) coal 1¼" 6" (p.b.c) coal ½" dk. brn. sh. ½" coal 1" dk. brn. sh. 1¼" (b.c.) coal ¾" dk. brn. sh. 3½" (p.b.c) coal ¾" carb. sh. 2" coal ¼" carb. sh. 3¼" coal ½" bnn. sh. 1¾" (b.c) coal 8½" (p.b.c) coal

307'2" 1" carb. sh. 1¾" med. gy. sh. 5½" med. gy. slts.

10¼" l. gy. → med. gy. f. ss

303'3¾" ½" (b.c) coal 1¼" med. gy. sh. 1" carb. sh. 1" coal ½" carb. sh. 2" (p.b.c.) coal ½" bnn. sh. 1" coal 1¼" bnn. sh. 2" coal ¼" carb. sh. 3¼" (p.b.c) coal and inf. coal ¼" med. gy. sh. 3" inf. coal 1" bnn. sh. 1¼" (b.c) coal ½" bnn. sh. 1" coal 1¼" bnn. sh. 2¼" dk. gy. sh. 2½" (b.c) coal.

310'5"

311'5"

Prox Analysis Recovery Section — Washability &c. per cent sampled | Section N.S.169 | Description

A% 38·1 S.G. 1·63 W x

Prox. Anal. of Comp. of Floats
M.% 2·2 V.M.% 28·2 F.C.% 52·2 A% 17·4 3·4% 0·43 87·5 807/57 B.T.U/lb 11850 S.G. 1·37 Coking test Class Cw. S.I. 3·5

Overall Recovery 95·3% — 152'2" – 163'9"

152'2" 2" carb. sh. 1½" coal 1" dk. gy. sh. 1½" inf. coal 1½" carb. sh. 1¼" inf. coal → coal ¾" carb. sh. 1" coal 1" brn. sh. lens. ½" coal 1¾" carb. sh. 1½" brn. sh. 2¾" carb. sh. 1½" dk. gy. sh. 1¾" fwn. sh. 1½" carb. sh. ¾" inf. coal 1" carb. sh. ½" coal ¾" dk. brn. sh. 4¼" (p.b.c) coal 1¾" carb. sh. 1½" coal ¾" carb. sh. 1" dk. gy. sh. 2¼" coal ¾" dk. brn. sh. 1¾" fwn. sh. 1" carb. sh. ½" coal 1" carb. sh. ½" coal ¾" carb. sh. 1½" fwn. sh. ¾" inf. coal 2" coal 3" (p.b.c) coal ½" carb. sh. 2¼" fwn. sh. 1¼" carb. sh. ¼" coal ¾" carb. sh. 1" fwn. sh. 1¼" coal ½" carb. sh. 2⅛" (p.b.c) coal ½" carb. sh. 1¼" coal ¾" carb. sh. 1" fwn. sh. 1¼" coal ½" carb. sh. 3

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JURASSIC SPORES AND POLLEN GRAINS FROM THE ROSEWOOD COALFIELD

By N. J. de JERSEY, Ph.D., M.Sc., Research Geologist

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JURASSIC SPORES AND POLLEN GRAINS FROM THE ROSEWOOD COALFIELD

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Abstract

Forty species of spores and pollen grains isolated from the coal seams of the Rosewood coalfield have been described and illustrated by photographs. Of these twenty-eight are recorded as new species, the remainder being identified or compared with species previously recorded from Australia, New Zealand and Europe. The new genus Annulispora *is established and its morphology described and illustrated. The microfossil assemblage is discussed in relation to the macro-flora from the same formation and it is concluded that the microflora has provided a more representative record of the fossil vegetation of the coal measures. Comparison with other Jurassic microfloras, particularly those of Western Australia, suggests a Lower Jurassic age for the Walloon Coal Measures in the type area. The investigation will provide a basis for a detailed account of spore distribution in relation to seam correlation in this coalfield.*

1. Introduction

The Rosewood coalfield covers an area of approximately 50 square miles more or less centred around the town of the same name, some 35 miles by rail west from Brisbane. The seams worked form part of the Walloon Coal Measures, a formation named after a town, 5 miles east of Rosewood, near which the first collieries in the district were located. These coal measures are regarded as Jurassic in age on the basis of their contained flora (David 1950, p. 469).

Owing to such factors as lack of outcrops, rarity of reliable marker beds, and marked variation in seam sections, seam correlation, by normal stratigraphic methods, is often a difficult task in this coalfield. Accordingly an investigation of the distribution of spores and pollen grains in the coal seams has been undertaken in order to provide an additional method of correlation. Preliminary reports, giving detailed results from the aspect of correlation, have been published for the areas so far examined (de Jersey 1955a, 1955b, 1957, 1958).

Although some areas of the coalfield still remain to be studied from the aspect of spore distribution, over one hundred samples, from all the principal coal horizons known in the district, have now been examined, and it seems likely that all the more abundant species of spores and pollen have been recognised. Consequently the purpose of this report is to record descriptions of all species known from this coalfield, so as to furnish a general picture of the microflora. It is hoped. in a later report, to describe in detail the vertical and lateral distribution of these species and their use in correlation.

2. Experimental Method

The coal samples studied were derived from two sources—channel samples collected in colliery workings and cores obtained in the diamond drilling programme of the Queensland Mines Department which began in 1952 in this coalfield, and is still in progress. Each sample was first crushed down to approximately quarter-inch screen size and sampled by conventional quartering methods; the coal was then further crushed down to minus-20 mesh and again sampled, dust and finely-divided coal being removed by screening through a 40-mesh sieve. Shale and shaly coal were then removed as the sinks in carbon tetrachloride (specific gravity 1.58), the float fraction consisting of relatively clean coal (average ash approximately 10 per cent.). After air-drying, 4 gm. of this final sample was taken for maceration. A period of 16-17 hours was found suitable for maceration with potassium chlorate and nitric acid, which was carried out by a technique similar to that previously described (de Jersey 1946, p. 2).

Three micro-slides were prepared from the maceration residue for each sample, 500 spores being examined in each case by traversing the slides systematically with the aid of a mechanical stage. Throughout the maceration process, the samples were treated in a standardised manner, so that results from different samples would be strictly comparable.

In spore content the coals proved to be relatively uniform, so that no significant variations could be detected in the total proportions of spores and pollens in the maceration residues, either vertically in the sequence or laterally in individual seams. Samples from the seams examined are all of approximately similar rank (high-volatile bituminous) and consist predominantly of bright coal (clarain) with an average proportion of 50 per cent. fixed carbon (dry, mineral-free basis).

3. Classification of Spores and Pollen Grains

The present position regarding the nomenclature of these microfossils has been well summarised by Balme (1957, pp. 13, 14). The writer is in substantial agreement with Balme's views, the only minor point of difference being that an attempt has been made in the present work to group genera on the basis of natural relationships (as has been done by Couper (1953)) rather than to follow an artificial scheme of supra-generic divisions, such as is advocated by Thomson and Pflug (1953).

In establishing new species the aim has been to base a specific diagnosis on an examination of at least

25 well preserved specimens, in order to study adequately variation in size ranges and other features. Only occasional exceptions have been permitted to this rule, in cases where species are relatively rare but exhibit very distinctive and easily recognisable characteristics. With regard to measurements of dimensions, specimens measured were those preserved in full polar view, the diameter of a triangular form being taken as the maximum median length, and the body diameter of a bisaccate pollen grain as the maximum dimensions of the body, measured in a direction parallel to the length of the furrow. In descriptive terminology the terms employed are largely those used by Balme (1957) and Harris (1955).

The specimens are located on numbered slides in the collection of the Geological Survey of Queensland. To facilitate examination of the type material, stage co-ordinates have been have been recorded for all type and figured specimens, along with the relevant slide numbers. These stage co-ordinates were determined using a Carl Zeiss Binocular Microscope (Model Lg Og, serial No. 322649).

4. Systematic Descriptions

Order SPHAGNALES

Family SPHAGNACEAE

Genus SPHAGNUMSPORITES Raatz

Remarks.—This genus has been discussed by Potonié (1956, p. 17) who listed *Sphagnites* Cookson (1953) as a synonym. This procedure is followed here, so that the species *Sphagnites australis* Cookson and *Sphagnites clavus* Balme are placed in *Sphagnumsporites*.

Sphagnumsporites australis (Cookson) Potonié

Plate 1, Figure 1

Trilites australis Cookson, 1947, B.A.N.Z. Antarctic Research Exped., Rept. A2(8), p. 136, pl. XV, figs, 58–59.

Sphagnites australis Cookson, 1953, Aust. J. Bot. Vol. 1, p. 463, pl. 1, figs. 1–4.

Sphagnumsporites australis (Cookson) Potonié, 1956, Beih. Geol. Jahrb. Part 23, p. 17.

Remarks.—The Rosewood spores referred to this species agree well with Cookson's diagnosis. They are rounded sub-triangular to sub-circular, with diameters from 20 to 45 microns, and laesurae usually extending almost to the periphery. The exine ranges from 2 to 5 microns in thickness. It has not been possible to group the specimens into two formae as has been done by Cookson (1953, p. 464), as there is continuous variation both in diameter and in the thickness of the exine. The species is long-ranged and relatively rare in most of the samples examined.

Figured specimen.—(Plate 1, Figure 1); Slide No. 276; Stage coordinates 7·5; 115·3; diameter 32 microns.

Locality.—Bore N.S. 42, 411 ft. 9¼ in. to 413 ft. 2¾ in.

Sphagnumsporites clavus (Balme), new combination

Plate 1, Figure 2

Sphagnites clavus Balme, 1957, C.S.I.R.O. Physical and Chemical Survey of the National Coal Resources, Reference T.C. 25, p. 16, pl. 1, figs. 4–6.

Remarks.—Specimens referred to this species compare closely with those figured and described by Balme. This similarity is shown by the size range (25 to 37 microns), thickness of exine (3 to 4 microns) and the nature of the ornamentation. Its occurrence in the Jurassic extends the stratigraphic range, as the species was recorded in Western Australia from sediments of Lower Cretaceous age.

Figured specimen.—(Plate 1, Figure 2); Slide No. 119; Stage coordinates 8·0, 107·5; diameter 27 microns.

Locality.—Bore N.S. 17, 132 ft. 1 in. to 135 ft. 10 in.

Sphagnumsporites tenuis, new species

Plate 1, Figure 3

Diagnosis.—Amb rounded triangular to sub-circular. Trilete, laesurae extending to, or almost to, the periphery. Diameter (based on 33 measured specimens) 20 to 40 microns. Exine smooth, about 1 micron in thickness.

Holotype.—(Plate 1, Figure 3); Slide No. 284; Stage coordinates 14·6 110·0; diameter 33 microns.

Locality.—Bore N.S. 84, 205 ft. 3 in. to 218 ft. 8 in.

Remarks.—This species is distinguished from *S. australis* (Cookson) by its thinner exine; the thickness is appreciably less even than the thinner forms of that species. Study of size distribution indicates a fairly even grouping around an average diameter of about 30 microns. The species resembles the thin-walled spores recorded by Cookson from the Comaum clays (Cookson 1953, p. 469, pl. 2, figs. 25, 26).

Sphagnumsporites adnatus, new species

Plate 1, Figure 4

Diagnosis.—Amb rounded triangular to sub-circular. Trilete, laesurae extending about two-thirds the distance to the periphery. Diameter (based on 40 measured specimens) 21 to 37 microns. Contact area marked by a proximal sub-triangular thickening of the exine, normally extending to ends of laesurae. Diameter of contact area 13 to 26 microns. Exine smooth, or with contact area faintly granulate, thickness 1 to 2 microns.

Holotype.—(Plate 1, Figure 4); Slide No. 242; Stage coordinates 16·2, 115·1; diameter 27 microns. Locality.—New Mountain View Colliery (Top section of seam).

Remarks.—*S. adnatus* shows some similarity to a species from the Permian of New South Wales, described as *Calamospora diversiformis* Balme and Hennelly 1956B, p. 246, pl. 2, figs. 14–18). However, the Rosewood specimens are appreciably smaller

in average diameter, their contact areas are more distinct and the laesurae are somewhat longer than in the Permian species.

Order LYCOPODIALES
Family LYCOPODIACEAE
Genus LYCOPODIUM Linnaeus

Lycopodium rosewoodensis, new species

Plate 1, Figures 5 and 6

Diagnosis.—Amb sub-circular. Trilete, indistinct laesurae, extending to the periphery. Diameter (based on 81 measured specimens) 25 to 46 microns. Exine about 1 micron thick, ornamented on the distal side by a regular polygonal reticulum, lumina 2 to 8 microns in diameter (average 4 microns), muri 1 micron wide, 1 to 2 microns in height at the spore margin. Equatorial flange absent.

Holotype.—(Plate 1, Figure 5); Slide No. 209; stage coordinates 10.0, 110.4; diameter 37 microns.

Locality.—Bore N.S. 42, 579 ft. 5½ in. to 580 ft. 8¾ in.

Paratype.—(Plate 1, Figure 6); Slide No. 259; stage coordinates 14.1, 107.2; diameter 40 microns.

Locality.—Bore N.S. 80, 110 ft. 7¼ in. to 117 ft. 11½ in. (United No. 8 Bottom Seam).

Remarks.—*L. rosewoodensis* shows a general similarity to spores of the *Lycopodium fastigiatum-volubile* group (see Harris 1955, pp. 53–55), but is distinct from any of the living species. It differs from *L. austroclavatidites* Cookson in having smaller lumina, and also narrower and lower muri. The species is also distinct from *L. austroclavatidities tenuis* Balme, which is appreciably smaller and exhibits a thin equatorial flange not observed in the Queensland specimens.

Lycopodium triangularis, new species

Plate 1, Figure 7

Diagnosis.—Amb triangular, sides straight or slightly convex, apices rounded. Trilete, indistinct laesurae, extending to the periphery. Diameter (based on 116 measured specimens) 20 to 50 microns. Exine about 1 micron thick, ornamented on the distal side by a regular polygonal reticulum, lumina 2 to 7 microns in diameter (average 4 microns), muri 1 micron wide, 1 to 2 microns in height at the spore margin. Equatorial flange absent.

Holotype.—(Plate 1, Figure 7); Slide No. 232; Stage coordinates 15.0, 114.2; diameter 36 microns.

Locality.—Bore N.S. 34, 49 ft. 5 in. to 57 ft. 1 in.

Remarks.—The ornamentation of this species is similar to that of *L. rosewoodensis.* However *L. triangularis* has a sharply triangular outline, and has been separated from that species because forms of intermediate shape have not been observed.

Order FILICALES
Family OSMUNDACEAE
Genus OSMUNDACIDITES Couper

Osmundacidites cf. *O. wellmanii* Couper

Plate 1, Figure 8

Description.—Amb rounded sub-triangular to sub-circular. Trilete, well-defined laesurae, extending to, or almost to, the periphery. Lips of tetrad-scar often slightly thickened. Diameter (based on 97 measured specimens) 33 to 61 microns. Exine about 1.5 micron thick, frequently folded, with folds of an arcuate nature. Ornamentation granular-papillate, varying from granular in the apical region, to slightly papillate at the periphery.

Figured Specimen.—(Plate 1, Figure 8); Slide No. 221; Stage coordinates 13.4, 114.0; diameter 43 microns.

Locality.—Bore N.S. 48, 116 ft. 0½ in. to 118 ft 4 in.

Remarks.—This species is close to *O. wellmanii* Couper but differs slightly in having more prominent lips to the tetrad-scar. It differs from *O. comaumensis* (Cookson) in the smaller size of the projections constituting the ornament.

Family GLEICHENIACEAE
Genus GLEICHENIA Smith

Gleichenia cf. *G. circinidites* Cookson

Plate 1, Figure 9

Description.—Amb triangular, margins slightly concave or convex, apices rounded. Trilete, well-defined laesurae, extending to the periphery. Diameter (based on 18 measured specimens) 25 to 45 microns. Exine smooth, 1 micron or less in thickness at apices, thickening between apices (up to 3.5 microns).

Figured Specimen.—(Plate 1, Figure 9); Slide No. 179; Stage coordinates 11.6, 111.0; diameter 33 microns.

Locality.—Bore N.S. 42, 213 ft. 2½ in. to 214 ft. 11½ in.

Remarks.—Under this heading are recorded spores similar to Cookson's species in shape and dimensions, which have narrower laesurae than that species. In size the Rosewood specimens are somewhat larger and are also thinner-walled than those described by Balme (1957, p. 23) as *G.* cf. *circinidites* from the Upper Jurassic and Lower Cretaceous. Specimens which can be definitely placed in *G. circinidites* have been observed by the writer in macerations of the Cretaceous Burrum coals, and these Cretaceous spores have wider laesurae and are darker in appearance than the Rosewood specimens.

PTERIDOPHYTA-INCERTAE SEDIS
Genus CYATHIDITES Couper

Cyathidites parvus, new species

Plate 1, Figure 10

Diagnosis.—Amb triangular, sides concave, apices sharply rounded. Trilete, laesurae faintly marked, extending also to the periphery. Diameter (based on 65 measured specimens) 20 to 35 microns. Exine smooth, relatively thin (less than 1 micron), often folded.

Holotype.—(Plate 1, Figure 10); Slide No. 300; Stage coordinates 7.5, 110.2; diameter 23 microns.

Locality.—Bore N.S. 42, 465 ft. 9½ in. to 468 ft. 8¾ in.

Remarks.—This species is distinguished from *C. minor* Couper by its smaller size, the majority of specimens examined being below the size range quoted for the New Zealand species. In addition the exine is somewhat thinner in *C. parvus*. With regard to the affinities of *Cyathidites*, Balme states (1957, p. 21) "There is little justification for regarding *Cyathidites* as more than a purely morphographic form genus, for although spores of this type occur among the Cyatheaceae, similar types are found in the Dicksoniaceae and Polypodiaceae."

Genus LEPTOLEPIDITES Couper

Leptolepidites verrucatus Couper

Plate 1, Figure 11

Remarks.—Specimens of this distinctive species agree closely with Couper's diagnosis. The size range (based on 30 measured specimens) is from 30 to 46 microns. The species is characterised by its large, irregularly shaped verrucate projections, averaging about 5 microns in diameter. The larger size range as compared with that of the New Zealand spores (31 to 35 microns) is probably due to the larger number of specimens measured, as the size range in the original description was based on 7 specimens only. Inevitably when further specimens are studied the size ranges are extended, and the separation of larger forms as another species (*L. major*) by Couper (Couper 1958, p. 141) may require confirmation by means of size-frequency distribution studies.

Couper (1953, p. 28) has discussed the resemblance to spores of the living fern *Leptolepia novae-zealandiae*, a number of the Dennstaediaceae. In addition Potonié (1956, p. 27) suggests comparison with *Alsophila cooperi*, in the family Cyatheaceae.

Figured Specimen.—(Plate 1, Figure 11); Slide No. 252; stage coordinates 15·0 110·2; diameter 43 microns.

Locality.—Bore N.S. 80, 154 ft. 8¼ in. to 162 ft. 2½ in.

Genus LEIOTRILETES (Naumova) Potonié and Kremp

Leiotriletes directus Balme and Hennelly

Plate 1, Figures 12 and 13

Remarks.—Under this species are recorded small, trilete, triangular forms indistinguishable from the Permian spores described by Balme and Hennelly (1956B, p. 244). As stated by those authors, *L. directus* is a very broad category embracing the spores of many plants. Thus an extended range, through several geological periods, is not unexpected for such a simple, generalised type of spore.

In the Rosewood specimens the diameter (based on 58 measured specimens) ranges from 17 to 37 microns; the exine is thin, smooth and frequently folded (see Plate 1, Figure 13).

Figured Specimen.—(Plate 1, Figure 12); Slide No. 276; stage coordinates 8·5, 110·5; diameter 30 microns.

Locality.—Bore N.S. 42, 411 ft. 9¼ in. to 413 ft. 2¾ in.

Figured Specimen.—(Plate 1, Figure 13); Slide No. 301; stage coordinates 11·0, 107·0; diameter 33 microns.

Locality.—Bore N.S. 42, 465 ft. 9½ in. to 468 ft. 8¾ in.

Leiotriletes magnus, new species

Plate 1, Figure 14

Diagnosis.—Amb triangular, sides straight or slightly convex in polar view. Trilete, laesurae well defined, extending to, or almost to, the periphery, with lips slightly developed. Diameter (based on 25 measured specimens) 41 to 65 microns. Exine thin (about 1 micron), smooth, subject to folding during compression.

Holotype.—(Plate 1, Figure 14); Slide No. 297; Stage coordinates 12·1, 105·8; diameter 57 microns.

Locality.—Bore N.S. 42, 512 ft. 9½ in. to 514 ft. 2 in.

Remarks.—*L. magnus* is larger than almost all of the unornamented species of *Leiotriletes*. The one exception is *L. grandis* (Kosanke) Bhardwaj, from the Carboniferous, which has a size range of 60 to 80 microns. However the latter species has a much more rounded outline, shorter laesurae, and a thicker exine.

Leiotriletes mortoni, new species

Plate 1, Figure 15

Diagnosis.—Amb triangular, sides slightly convex or concave in polar view. Trilete, tetrad scar prominent, laesurae extending to the periphery. Lips of tetrad scar thickened and slightly raised, width of scar (inclusive of lips) 3 to 8 microns. Diameter (based on 35 measured specimens) 20 to 40 microns. Exine smooth, relatively thin (about 1 micron).

Holotype.—(Plate 1, Figure 15); Slide No. 300; stage coordinates 7·9, 111·2; diameter 27 microns.

Locality.—Bore N.S. 42, 465 ft. 9½ in. to 468 ft. 8¾ in.

Remarks.—Two Carboniferous species, *L adnatoides* Potonié and Kremp and L. *subadnatoides* Bhardwaj also have thickened lips to the laesurae, but in each case the exine is finely ornamented. The species is named after the late Mr. C. C. Morton, former Chief Geologist, Geological Survey of Queensland, under whose direction this investigation was initiated.

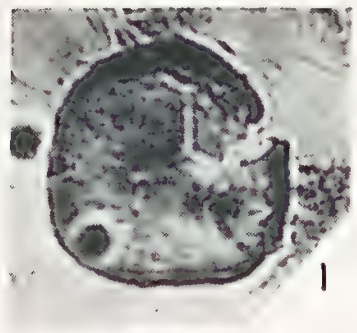
Leiotriletes crassus, new species

Plate 1, Figure 16

Diagnosis.—Amb triangular, sides slightly convex or concave in polar view. Trilete, laesurae indistinct, reaching the periphery. Diameter (based on 17

All the photographs are at a magnification of 830 diameters

Plate 1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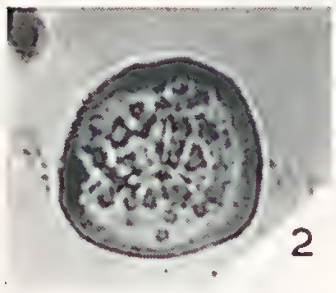
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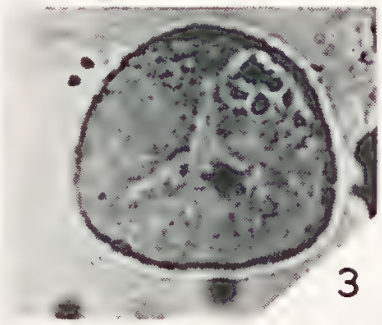
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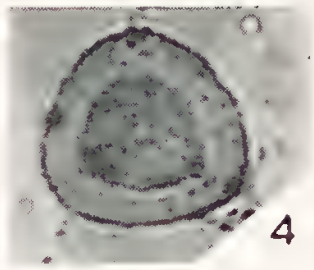
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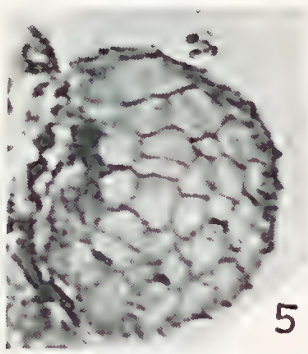
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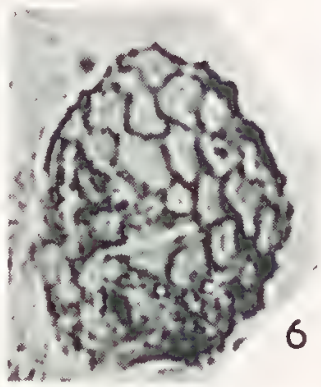
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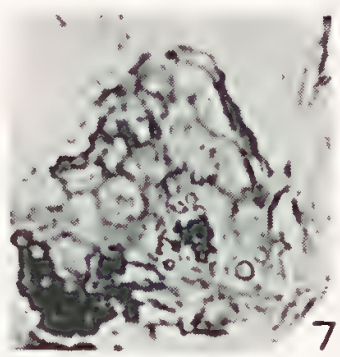
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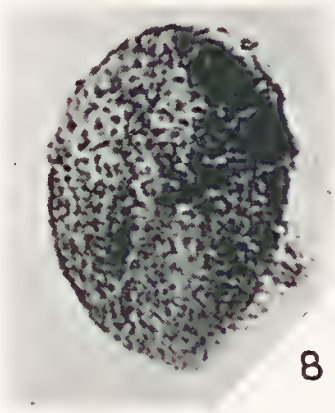
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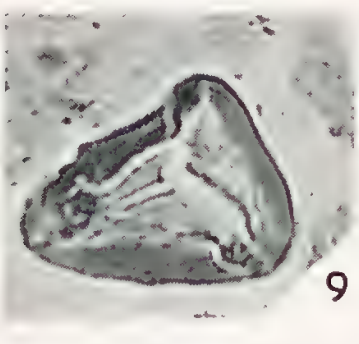
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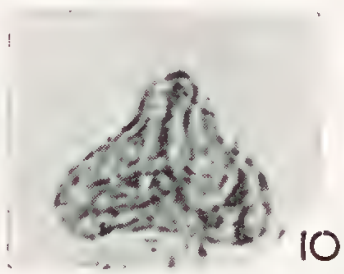
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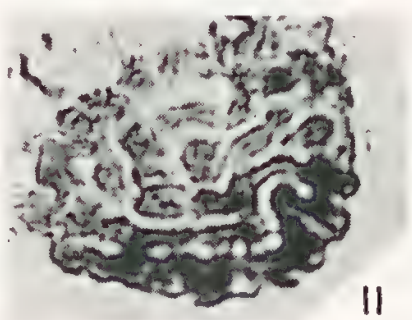
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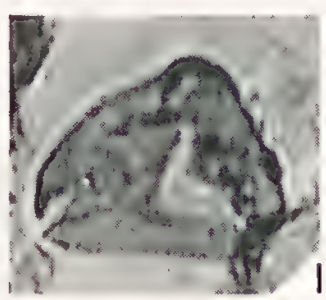
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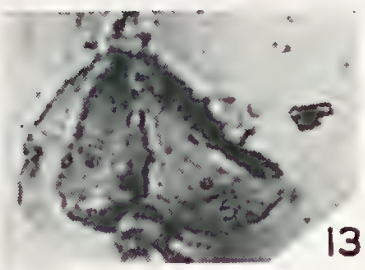
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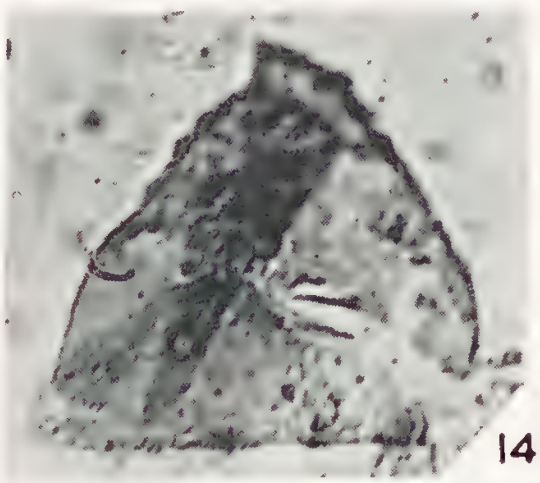
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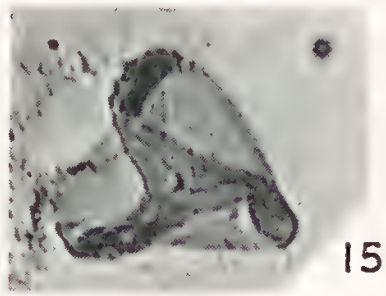
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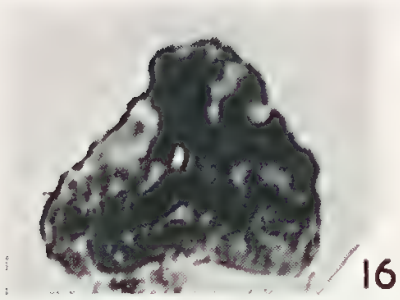
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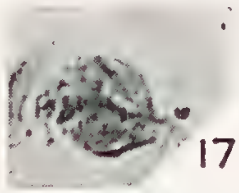
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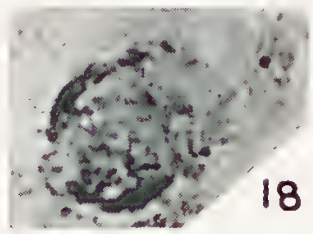
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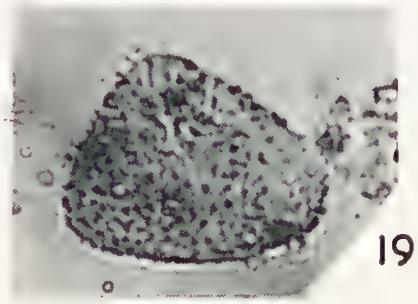
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Fig. 1.—*Sphagnumsporites australis* (Cookson) Potonié.
Fig. 2.—*Sphagnumsporites clavus* (Balme), n. comb.
Fig. 3.—*Sphagnumsporites tenuis* n. sp. Holotype.
Fig. 4.—*Sphagnumsporites adnatus* n. sp. Holotype.
Fig. 5.—*Lycopodium rosewoodensis* n. sp. Holotype.
Fig. 6.—*Lycopodium rosewoodensis* n. sp. Paratype.
Fig. 7.—*Lycopodium triangularis* n. sp. Holotype.
Fig. 8.—*Osmundacidites* cf *wellmanii* Couper.
Fig. 9.—*Gleichenia* cf *circinidites* Cookson.
Fig. 10.—*Cyathidites parvus*, n. sp. Holotype.
Fig. 11.—*Leptolepidites verrucatus* Couper.
Fig. 12.—*Leiotriletes directus* Balme & Hennelly, Proximal view.
Fig. 13.—*Leiotriletes directus* Balme & Hennelly. Folded specimen (laterally compressed).
Fig. 14.—*Leiotriletes magnus* n. sp. Holotype.
Fig. 15.—*Leiotriletes mortoni* n. sp. Holotype.
Fig. 16.—*Leiotriletes crassus* n. sp. Holotype.
Fig. 17.—*Punctatisporites minimus* n. sp. Holotype.
Fig. 18.—*Cyclogranisporites breviradiata* n. sp. Holotype.
Fig. 19.—*Granulatisporites minor* n. sp. Holotype.

measured specimens) 20 to 37 microns. Exine smooth, relatively thick (about 3 microns) appearing dark brown in transmitted light.

Holotype.—(Plate 1, Figure 16); Slide No. 102; Stage coordinates 12·1, 110·3; diameter 36 microns.

Locality.—Bore N.S. 17, 356 ft. 1½ in. to 358 ft. 6 in.

Remarks.—The thick exine and dark colour of this species are characteristic. Somewhat similar spores occur in the living species. *Dicksonia fibrosa* (see Harris 1955, p. 86), which is, however, appreciably larger (size range 43 to 53 microns).

Genus GRANULATISPORITES (Ibrahim) Potonié and Kremp

Granulatisporites minor, new species

Plate 1, Figure 19

Diagnosis.—Amb. triangular, sides straight or slightly convex in polar view. Trilete, laesurae indistinct, extending to the periphery. Diameter (based on 35 measured specimens) 20 to 35 microns. Exine about 1 micron thick, ornamented with small, closely packed granulations (diameter 1 micron or less), becoming slightly papillate at the periphery.

Holotype.—(Plate 1, Figure 19); Slide No. 139; Stage coordinates 14·4, 103·6; diameter 32 microns.

Locality.—Bore N.S. 40, 238 ft. to 240 ft. 6½ in.

Remarks.—The ornamentation of this species is rather similar to that of *Osmundacidites wellmanii* Couper, and thus may suggest affinity with the Osmundaceae. However, other families, notably the Hymenophyllaceae also exhibit this granulate-papillate type of ornament. The species is readily distinguished by its size and ornamentation, from previously described species of *Granulatisporites.*

Genus CYCLOGRANISPORITES Potonié and Kremp

Remarks.—*Cyclogranisporites* constitutes a convenient form-genus for the reception of species of unknown affinity, characterised by their circular shape and granulate sculpture, such as *C. breviradiata* described below.

Cyclogranisporites breviradiata new species

Plate 1, Figure 18

Diagnosis.—Amb circular or well-rounded triangular. Diameter (based on 105 measured specimens) 20 to 55 microns. Exine relatively thin (about 1 micron), with occasional folds, granulate with closely packed projections up to 1 micron in diameter.

Holotype.—(Plate 1, Figure 18); Slide No. 139; Stage coordinates 9·4, 114·8; diameter 21 microns.

Locality.—Bore N.S. 40, 238 ft. to 240 ft. 6½ in.

Remarks.—*C. breviradiata* is distinguished from previously described species of the genus by its smaller size and short laesurae.

Genus PUNCTATISPORITES (Ibrahim) Potonié and Kremp

Punctatisporites crassiradiata, new species

Plate 2, Figure 1

Diagnosis.—Amb circular or sub-circular. Trilete, prominent laesurae extending to, or almost to, the periphery. Lips thickened, total width of rays 4 to 10 microns. Diameter (based on 27 measured specimens) 50 to 95 microns. Exine smooth, 1 to 2 microns thick, frequently folded, folds often of an arcuate nature.

Holotype.—(Plate 2, Figure 1); Slide No. 148; Stage coordinates 14.6, 104.1; diameter 93 microns.

Locality.—Bore N.S. 40, 206 ft. 0½ in. to 207 ft. 5¼ in.

Remarks.—This species can be compared with *P. gretensis* Balme and Hennelly from the Permian, from which it differs in having a thinner exine, longer laesurae, and a smaller size range. There is also a general similarity to certain species of *Calamospora,* but in that genus the laesurae are distinctly shorter.

Punctatisporites minimus, new species

Plate 1, Figure 17

Diagnosis.—Amb circular or sub-circular. Trilete, laesurae extending almost to the periphery. Diameter (based on 48 measured specimens, 10 to 21 microns. Exine smooth, relatively thin (less than 1 micron).

Holotype.—(Plate 1, Figure 17); Slide No. 217; Stage coordinates 16·5, 108·7; diameter 15 microns.

Locality.—Bore N.S. 48, 187 ft. 4½ in. to 191 ft. 9 in.

Remarks.—The small size of this species is distinctive and readily enables separation from other described species of *Punctatisporites.*

Genus VERRUCOSISPORITES (Ibrahim 1932) Emend.

In view of the occurrence of a species (*V. triangularis*) in the Rosewood coals which has ornamentation typical of *Verrucosisporites,* but differs from previously described species of the genus in its triangular outline, Bhardwaj's (1955) emended diagnosis is emended as follows:—Trilete iso-or microspores of triangular to sub-triangular or circular outline and without other differentiation than the warty exoexine, its warts being closely set and often bigger than the *grana* of *Granulatisporites,* but not so uniform in size. The base of wart is broader than its bluntly conical or flat apex.

Verrucosisporites walloonensis, new species

Plate 2, Figure 8

Diagnosis.—Amb rounded sub-triangular or sub-circular. Trilete, laesurae indistinct; when observed relatively inconspicuous. Diameter (based on 65 measured specimens) 27 to 45 microns. Exine thin, ornamented with rounded sub-hemispherical to bluntly conical projections 2 to 3 microns in diameter and 1 to 3 microns apart.

Holotype.—(Plate 2, Figure 8); Slide No. 148; Stage coordinates 15·0, 108·5; diameter 35 microns.

Locality.—Bore N.S. 40, 206 ft. 0½ in. to 207 ft. 5¼ in.

Remarks.—*V. walloonensis* differs from most of the Permian species described by Balme and Hennelly (1956, pp. 250, 251) in its smaller size; the dimensions are roughly similar to those of *V. parmatus* Balme and Hennelly but the latter species has a clearly defined contact area. It also differs from *Baculatisporites truncatus* (Cookson) Balme in having smaller, more rounded projections and less distinct laesurae.

Verrucosisporites triangularis, new species

Plate 2, Figure 9

Diagnosis.—Amb triangular, sides straight or slightly convex. Trilete, laesurae indistinct, where observed extending to the periphery. Diameter (based on 48 measured specimens) 22 to 45 microns. Exine thin, ornamented with rounded (sub-hemispherical) projections 2 to 3 microns in diameter, and 1 to 4 microns apart.

Holotype.—(Plate 2, Figure 9); Slide No. 157; stage coordinates 6·6, 112·6; diameter 30 microns.

Locality.—Bore N.S. 40, 176 ft. 7¾ in. to 177 ft. 11¾ in.

Remarks.—This species differs from *V. walloonensis* described above in having a distinctly triangular outline and longer laesurae, extending to the periphery.

Genus ACANTHOTRILETES (Naumova) Potonié and Kremp

Acanthotriletes pallidus, new species

Plate 2, Figure 10

Diagnosis.—Amb rounded triangular to circular. Trilete, laesurae indistinct, where observed extending almost to the periphery. Diameter (based on 35 measured specimens) 30 to 53 microns. Exine about 1 micron thick, ornamented on the distal side by scattered, acicular processes, about 2 to 3 microns long and 1·5 microns in basal diameter. Ornament reduced or absent on proximal face.

Holotype.—(Plate 2, Figure 10); Slide No. 196; Stage coordinates 16·2, 110·4; diameter 32 microns.

Locality.—Bore N.S. 42, 484 ft. 1 in. to 487 ft. 0¼ in.

Remarks.—The ornamentation of this species is of the same general type as in *A. levidensis* Balme from the Cretaceous of Western Australia, from which species *A. pallidus* differs in being appreciably larger and in having poorly defined laesurae. The following remarks regarding the affinities of *A. levidensis* by Balme (1957, p. 18) could apply equally well to the Queensland species:—"Although spinose ornament of this type is not often found among the spores of present-day ferns, it occurs occasionally among other pteridophyte groups, notably the Selaginellaceae. Perhaps the closest modern resemblance is to be found in the spores of the *Selaginella subarborescens* group as this was delimited by Knox (1950)".

Genus RUGULATISPORITES Pflug

Remarks.—The species *R. ramosus* described below fits well the generic diagnosis quoted by Potonié (1956, p. 38). The genotype is of Tertiary age and has suggested affinities with the Osmundaceae.

Rugulatisporites ramosus, new species

Plate 2, Figures 5 and 6

Diagnosis.—Amb circular. Laesurae ill-defined, often obscured by ornamentation, where observed reaching almost to periphery. Diameter (based on 45 measured specimens) 30 to 43 microns. Exine about 1·5 micron thick, ornamented with sinuous ridges, often branching, averaging 2·5 microns in width and 1 micron in height, and 2 to 3 microns apart.

Holotype.—(Plate 2, Figure 5); Slide No. 146; Stage coordinates 10·0, 105·9; diameter 41 microns.

Locality.—Bore N.S. 40, 221 ft. 6¼ in. to 222 ft. 11¼ in.

Paratype.—(Plate 2, Figure 6); Slide No. 209; Stage coordinates 14·1, 114·0; diameter 37 microns.

Locality.—Bore N.S. 42, 579 ft. 5½ in. to 580 ft. 8¾ in.

Remarks.—*R. ramosus* differs from the genotype *R. quintus* Thomson and Pflug in its smaller size, and in having less closely-spaced ridges.

Genus CINGULATISPORITES Thomson

Cingulatisporites granulatus, new species

Plate 2, Figure 7

Diagnosis.—Amb rounded triangular to sub-circular. Spore complex, consisting of a central body surrounded equatorially by a hyaline cingulum 3 to 6 microns wide. Trilete, laesurae extending to the junction of the central body and cingulum. Total diameter (based on 10 measured specimens) 33 to 50 microns; diameter of body 27 to 37 microns. Exine 1 to 2 microns thick, proximal side smooth, distal face granulate-echinate, ornamented by close-packed granulate to bluntly spinose projections 1 to 3 microns in length and 1 to 2 microns in basal diameter. Cingulum smooth.

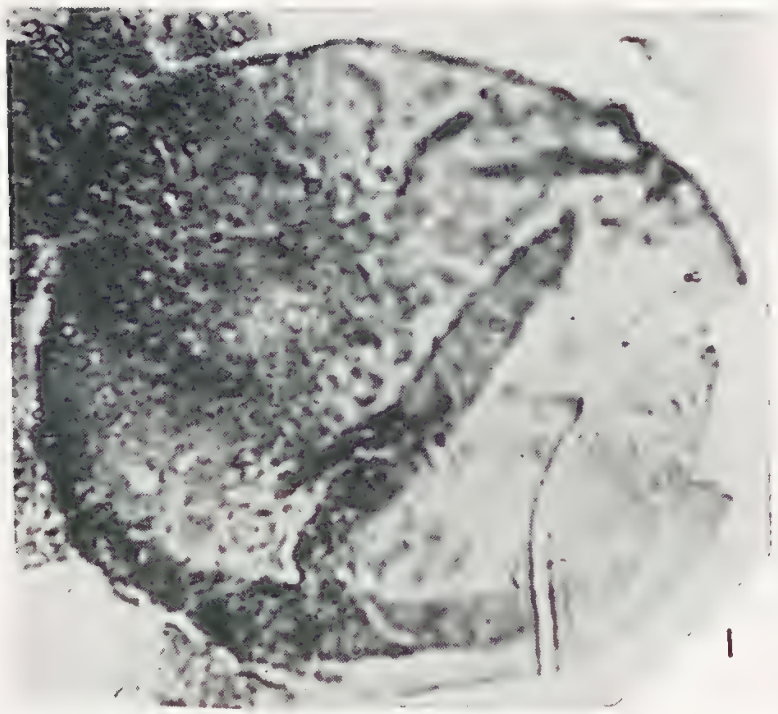
Holotype.—(Plate 2, Figure 7); Slide No. 199; Stage coordinates 7·5, 107·1; diameter 35 microns.

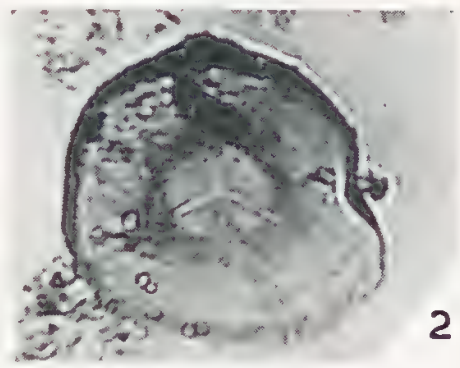
Locality.—Bore N.S. 42, 515 ft. 7¼ in. to 522 ft. 1½ in.

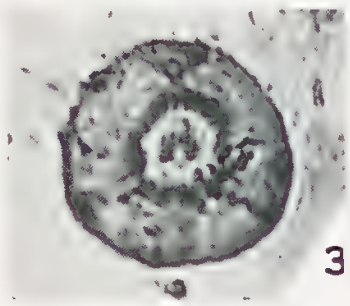
Remarks.—This species can be compared with *C. saevus* Balme from the Upper Jurassic, from which it is distinguished by the finer ornamentation of the central body and the slightly narrower cingulum. Regarding the affinities of the latter species, Balme states (1957, p. 26) "Perhaps the closest morphological omalogies are to be found in the spores of the *Selaginella scandens*—group (see Knox 1950, p. 254)."

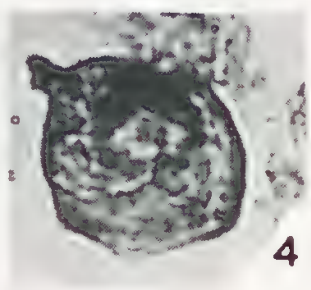
All the photographs are at a magnification of 840 diameters

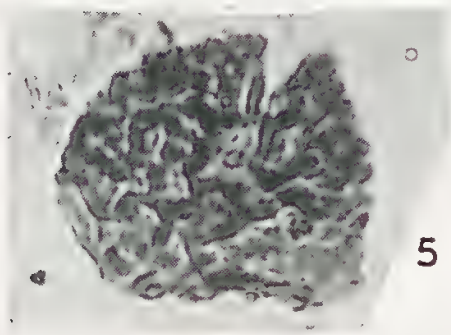
Plate 2

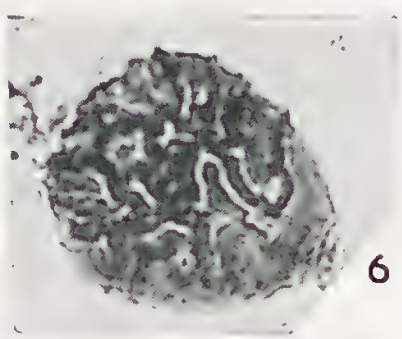


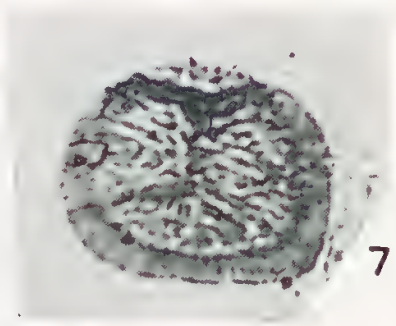


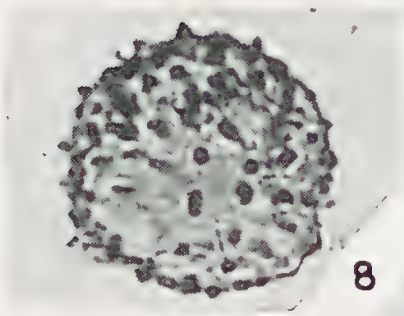


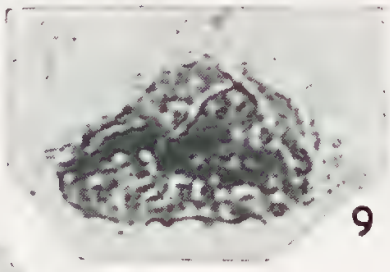


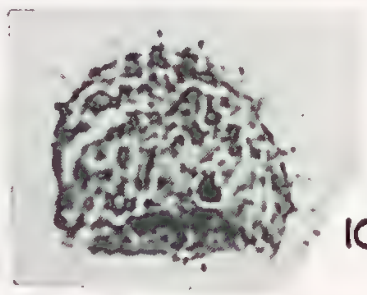


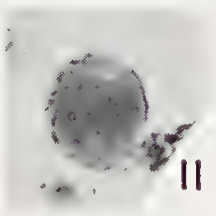


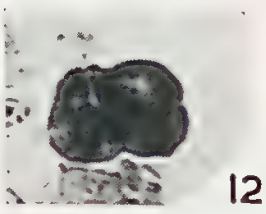


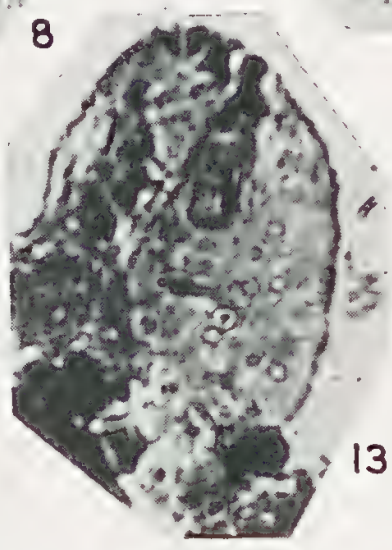


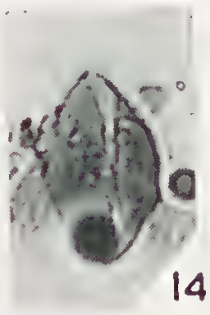


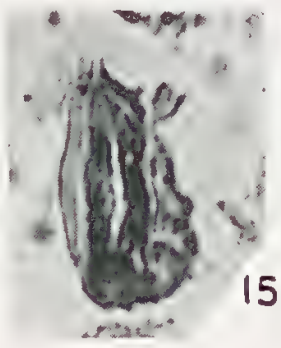












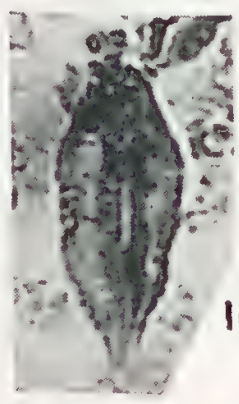


Fig. 1.—*Punctatisporites crassiradiata* new species. Holotype.
Fig. 2.—*Annulispora folliculosa* (Rogalska) n. comb.
Fig. 3.—*Annulispora densata* n. sp. Holotype (specimen compressed proximo-distally).
Fig. 4.—*Annulispora densata* n. sp. Paratype (specimen compressed laterally).
Fig. 5.—*Rugulatisporites ramosus* n. sp. Holotype.
Fig. 6.—*Rugulatisporites ramosus* n. sp. Paratype.
Fig. 7.—*Cingulatisporites granulatus* n. sp. Holotype.
Fig. 8.—*Verrucosisporites walloonensis* n. sp. Holotype.
Fig. 9.—*Verrucosisporites triangularis* n. sp. Holotype.
Fig. 10.—*Acanthotriletes pallidus* n. sp. Holotype.
Fig. 11.—*Pilasporites minutus* n. sp. Holotype.
Fig. 12.—*Pilasporites crassus* n. sp. Holotype (specimen on right)
Fig. 13.—*Marsupipollenites psilatus* n. sp. Holotype.
Fig. 14.—*Entylissa nitidus* Balme
Fig. 15.—*Entylissa crassimarginis* n. sp. Paratype.
Fig. 16.—*Entylissa crassimarginis* n. sp. Holotype.

SPORES—INCERTAE SEDIS

Genus ANNULISPORA, new genus

The generic name *Annulispora* is proposed for isolated fossil spores of unknown affinities having the following characters:

Amb circular or rounded triangular. Trilete, laesurae distinct, of variable length (average length about two-thirds of the spore radius). Exine smooth or faintly roughened, about 2 to 3 microns thick. The distal portion of the spore wall exhibits a thickened sub-circular ring, about 2 to 5 microns in width, with a sharp inner boundary, and a more gradual demarcation from the outer portion of the spore body.

Type species (here designated).—*Annulispora folliculosa* (Rogalska) new combination (Rogalska 1954, pp. 26, 44, pl. 12, fig. 8).

Remarks.—The type species was originally described as *Sporites folliculosus* Rogalska. Regarding the name *"Sporites"* Schopf, Wilson, and Bentall state (1944, p. 60) "The names *Sporites* (H. Potonié, 1892), *Pollenites* and *Sporonites* (R. Potonié, 1931) cannot be regarded as having systematic value. Forms listed in these groups have no essential biological features in common, no type species are recognised, and no systematic treatment is feasible on this basis." Consequently the species has been transferred to the new genus *Annulispora* now established.

Examination of the figure of a second species described as *Sporites lunaris Rogalska* (Rogalska 1954, pp. 26, 45; pl. 12, fig. 9) suggests that it represents a specimen of *Annulispora folliculosa* flattened laterally, so that it is observed in oblique equatorial view, and the distal ring is superimposed on one of the laesurae of the triradiate tetrad scar. In the other photograph (plate 12, fig. 8) the same species is observed in polar view, flattened in good proximal–distal orientation, so that the distal ring is superimposed symmetrically on the trilete tetrad-scar.

Similar variations in appearance due to flattening in different positions have been observed in specimens of the same species from the Rosewood coalfield. Consequently *Sporites lunaris* Rogalska is regarded as a synonym of *Annulispora folliculosa* (Rogalska) new combination.

Annulispora folliculosa (Rogalska) new combination

Plate 2, Figure 2

Sporites folliculosus Rogalska 1954. Inst. Geol. Bull. 89 (Warsaw), pp. 26, 44, pl. XII, fig. 8.

Sporites lunaris Rogalska 1954. Inst. Geol. Bull. 89 (Warsaw), pp. 26, 45, pl. XII, fig 9.

Emended diagnosis.—Amb circular or rounded triangular. Trilete, laesurae distinct, of variable length (average length about two-thirds of the spore radius). Diameter (based on 103 measured specimens) 23 to 48 microns. Exine smooth, or faintly roughened, about 2 to 3 microns thick. The distal portion of the spore wall exhibits a thickened sub-circular ring of exine, about 2 to 5 microns in windth, with a sharp inner boundary, and a more gradual demarcration from the outer portion of the spore body. Internal diameter of ring 7 to 17 microns.

Figured specimen.—(Plate 2, Figure 2); Slide No. 196; stage coordinates 7·5, 111·8; diameter 42 microns.

Locality.—Bore N.S. 42, 484 ft. 1 in. to 487 ft. 0¼ in.

Remarks.—The type material was derived from the Blanowice coal in Upper Silesia, Poland, the age of which is regarded as Liassic (Rogalska 1954, pp. 41–43). The species is also present in small proportions in most samples of the Rosewood coals which have been examined.

The only spore type recorded among Recent ferns to which *Annulispora* shows any resemblance is that of the species *Saccoloma inequale,* a member of the Dicksoniaceae. In this species (see Knox 1938, pp. 454) "the wall is locally banded to form a thickened circular area from which extensions may pass to the margin of the spore, the corners of which are also conspicuously thickened." *Annulispora* resembles this species in having a thickened circular area of the exine, but differs in lacking the extensions of the thickening to the spore margin and apices.

The only fossil form to which it can be compared is *Exesipollenites tumulus* Balme, from the Lower Jurassic of Western Australia (Balme 1957, p. 39). The latter species also exhibits a ring-shaped thickened portion surrounding a circular depression formed by thinner exine. However, no tetrad markings are visible in *Exesipollenites,* which genus Balme considers to represent pollen grains of unknown affinities. In addition the distal (?) circular depression is somewhat smaller than in *Annulispora.* Of the two genera *Annulispora* appears to have a longer range as it has been observed by the writer in some of the seams of the Ipswich Coal measures, of Triassic age, as well as in the Walloon Coal measures at Rosewood. In Western Australia *Exesipollenites* is confined to the Lower Jurassic (Balme 1957, Table 3).

Annulispora densata, new species

Plate 2, Figures 3 and 4

Diagnosis.—Amb circular or rounded triangular. Trilete, laesurae distinct, of variable length (average length about two-thirds of the spore radius). Diameter (based on 20 measured specimens) 26 to 42 microns. Exine smooth, about 2 to 3 microns thick. The distal portion of the spore wall exhibits a thickened sub-circular ring of exine, about 2 to 5 microns in width, with a sharp inner boundary, and a more gradual demarcation from the outer portion of the spore body. Internal diameter of the ring about 8 to 10 microns. Spore body characterised by a dark brown thickened portion 3 to 5 microns in diameter located centrally on its distal surface.

Holotype.—(Plate 2, Figure 3) (flattened proximo-distally); Slide No. 142; Stage coordinates 9·5 112·5; diameter 30 microns.

Locality.—Bore N.S. 40, 230 ft. 8¼in to 232 ft. 11¼ in.

Paratype.—(Plate 2, Figure 4) (flattened laterally); Slide No. 206; Stage coordinates 16·0, 106·8; diameter 27 microns.

Locality.—Bore N.S. 42, 546 ft. 8 in to 547 ft. 1¾ in.

Remarks.—This species is distinguished from *A. folliculosa,* described above, principally by the occurrence of a thickened portion of exine located centrally on the distal surface.

Genus PILASPORITES Balme and Hennelly

Remarks.—Balme and Hennelly (1956A, p. 64) have proposed this genus for alete spores of unknown affinities and have pointed out the difficulties of classifying spores in the absence of germinal apparatus.

Pilasporites minutus, new species

Plate 2, Figure 11

Diagnosis.—Outline circular or sub-circular. No germinal mechanism visible. Diameter (based on 89 measured specimens) 7 to 17 microns. Exine smooth, one micron or less in thickness.

Holotype.—(Plate 2, Figure 11); Slide No. 294; Stage coordinates 16·1, 105·5; diameter 15 microns.

Locality.—Bore N.S. 84, 235 ft. 0¼ in. to 238 ft. 2½ in.

Remarks.—The affinities of alete spores of this type are unknown.

Pilasporites crassus, new species

Plate 2, Figure 12

Diagnosis.—Outline circular or sub-circular. No germinal mechanism visible. Diameter (based on 53 measured specimens 9 to 17 microns. Exine smooth, relatively thick, appearing dark brown in transmitted light.

Holotype.—(Plate 2, Figure 12, specimen on right); Slide No. 197; Stage coordinates 9·0, 113·8; diameter 12 microns.

Locality.—Bore N.S. 42, 484 ft. 1 in to 487 ft. 0¼ in.

Remarks.—The affinities of alete spores of this type are unknown.

GYMNOSPERMAE

The pollen grains described under this heading include some forms which show affinity with certain families, e.g. the Podocarpaceae, but in view of the difficulties involved in classifying many of the pollen genera from the early Mesozoic, no supra-generic classification has been attempted here.

Genus MARSUPIPOLLENITES Balme and Hennelly

Marsupipollenites psilatus, new species

Plate 2, Figure 13

Diagnosis.—Amb of unexpanded grain oval. Distal furrow bordered by two longitudinal overfolds extending almost the full length of the grain. Small trilete tetrad scar on proximal face, rays of scar about 4 microns long. Length of longitudinal axis (based on 25 measured specimens) 65 to 95 microns, transverse axis 37 to 67 microns. Exine 1 to 2 microns in thickness, smooth, light yellow in transmitted light.

Holotype.—(Plate 2, Figure 13); Slide No 302; Stage coordinates 13·4, 107·4; dimensions 65 x 43 microns.

Locality.—Bore N.S. 46, 88 ft. 10 in to 95 ft.

Remarks.—*M. psilatus* is similar in many respects to *M. triradiatus* Balme and Hennelly from the Permian, but differs in having a smooth exine. It is also distinct from the forms described as *Marsupipollenites sp.* from the Lower Jurassic of Western Australia (Balme 1957, p. 29) which were characterised by their long triradiate markings, subtriangular shape and rugose ornamentation. The affinities of *Marsupipollenites* are probably with the Pteridospermae (see Balme and Hennelly 1956A, p. 60).

Genus ENTYLISSA Naumova ex Potonié and Kremp

Entylissa nitidus, Balme

Plate 2, Figure 14

Description.—Amb elongated oval, extremities rounded to sharply pointed. Monocolpate, furrow extending full length of the distal surface. Length (based on 63 measured specimens) 20 to 45 microns, width 11 to 25 microns. Exine 1 micron or less thick, smooth or faintly granulate.

Figured specimen.—(Plate 2, Figure 14); Slide No. 304; Stage coordinates 15·0, 111·5; length 25 microns, width 15 microns.

Locality.—Bore N.S. 46, 88 ft. 10 in. to 95 ft.

Remarks.—The differences between the Rosewood specimens and the Western Australian species *E. nitidus* Balme are relatively slight so that the pollen grains described here have been recorded under that species. The Rosewood specimens have a larger size range, and also exhibit some variation in shape, the extremities ranging from well rounded to sharply pointed. However detailed study has shown that there is continuous variation, both in size and shape of the extremities, and that no grouping of the forms is possible.

Regarding distribution and affinities Balme states (1957, p. 30) "*Entylissa nitidus* occurred in almost all the upper Jurassic and Lower Cretaceous samples and was sometimes very common. It almost certainly includes the pollen of many Mesozoic plants of

Cycadalean or Bennettitalean affinities." In addition pollen grains of similar type have been recorded from the Pteridosperm *Lepidopteris ottonis* (see Lundblad 1949, p. 5).

Entylissa crassimarginis, new species

Plate 2, Figures 15 and 16

Diagnosis.—Amb elongated oval. Monocolpate, furrow extending full length of the distal surface, each furrow margin thickened for an average width of about 3 microns. Length (based on 63 measured specimens) 20 to 45 microns, width 10 to 31 microns. Exine smooth, 1 micron or less in thickness.

Holotype.—(Plate 2, Figure 16); Slide No. 91; Stage coordinates 13·1, 107·7; length 40 microns, width 17 microns.

Locality.—Bore N.S. 11, 301 ft. 7½ in. to 302 ft. 11 in.

Paratype.—(Plate 2, Figure 15); Slide No. 238; Stage coordinates 9·6, 114·7; length 33 microns, width 17 microns.

Locality.—Bore N.S. 56, 840 ft. 3¼ in. to 840 ft. 6¼ in.

Remarks.—*E. crassimarginis* has a similar size range and shape to the specimens referred to *E. nitidus* Balme, being distinguished by the conspicuous thickening of the furrow margins.

Entylissa magna, new species

Plate 3, Figure 1

Diagnosis.—Amb elongated oval, Monocolpate, furrow extending full length of distal face without conspicuous development of furrow margins. Length (based on 38 measured specimens) 60 to 110 microns, width 27 to 66 microns. Exine smooth, 1 to 2 microns in thickness.

Holotype.—(Plate 3, Figure 1); Slide No. 238; Stage coordinates 14·5, 115·5; length 87 microns, width 47 microns.

Locality.—Bore N.S. 56, 840 ft. 3¼ in. to 840 ft. 6¼ in.

Remarks.—This species has been separated from the specimens described above under *E. nitidus* Balme on the basis of its larger size, less prominent furrow, and slightly thicker exine. Its affinities are considered to be with the Bennettitales or Cycadales.

Genus CAYTONIPOLLENITES (Couper 1958) Emend.

Remarks.—The recent definition of this genus (Couper, 1958, p. 149) provides an appropriate designation for small, disaccate pollen grains resembling the pollen of *Caytonanthus* Harris, a genus of the Caytoniales. The genus is distinguished from winged conifer pollen grains by its small size, elongated body and very thin exine. The specimens from the Rosewood coals described below agree with Couper's generic diagnosis in all particulars except that the bladders in the Queensland pollens are smooth to very faintly ornamented. Accordingly the generic diagnosis is amended as follows:—"Pollen grains, very small, usually less than 35 mircons overall; disaccate or rarely trisaccate, body of grain oval in polar view, longer than broad; exine of body very thin and finely scabrate to smooth; bladders large in relation to body, smooth or sculptured with fine thickenings, forming an obscure reticulum." The occurrence of species with smooth bladders in this genus has an analogy in *Caytonanthus kochi Harris,* in which species the bladder surface is nearly smooth, showing only the most indistinct thickenings and pits.

Caytonipollenites contectus, new species

Plate 3, Figures 2 and 3

Diagnosis.—Pollen grain disaccate. Central body oval in polar view; longer than broad; exine smooth, very thin (less than 1 micron). Total span of grain (based on 25 measured specimens) 25 to 45 microns; length of body 15 to 30 microns; breadth of body 13 to 25 microns; average ratio of length to breadth of body 1·5. Bladders large in relation to size of body, attached with a slight distal inclination. Bladders covering body except for a narrow median longitudinal portion, 1 to 2 microns in width, extending complete length of body. Bladders smooth or very faintly granulate (?), less than 1 micron in thickness.

Holotype.—(Plate 3, Figure 2); Slide No. 79; Stage coordinates 16·0, 109·9; total span 33 microns.

Locality.—Bore N.S. 11, 361 ft. 8 in. to 363 ft. 6 in.

Paratype.—(Plate 3, Figure 3); Slide No. 85; Stage coordinates 12·0, 113·6; total span 25 microns.

Locality.—Bore N.S. 11, 331 ft. to 332 ft. 6 in.

Remarks.—This species is distinguished from the only previously described species *C. pallidus* (Reissinger) Couper, by the lack of well-defined bladder ornamentation and also by the extreme overlap of the bladders, covering most of the body surface. Like that species, its affinities are probably with the Caytoniales.

Caytonipollenites subtilis, new species

Plate 3, Figure 4

Diagnosis.—Pollen grain disaccate. Central body oval in polar view; longer than broad; exine smooth, very thin (less than 1 micron). Total span of grain (based on 54 measured specimens) 23 to 50 microns; length of body 14 to 28 microns; breadth of body of 12 to 25 microns; average ratio of length to breadth of body 1·5. Bladders large in relation to size of body, attached with slight distal inclination. Bladders overlapping body except for a median portion 5 to 10 microns in width, extending length of body. Bladders smooth or faintly granulate (?), less than 1 micron in thickness. Length of bladders equal to, or slightly greater than, length of body.

Holotype.—(Plate 3, Figure 4); Slide No. 113; Stage coordinates 9.0; 105-7; total span 37 microns.

Locality.—Bore N.S. 17, 200 ft. 9 in. to 205 ft. 4¾ in.

Remarks.—*C. subtilis* differs from *C. contectus,* described above, in having a much greater proportion of the body surface exposed due to the lesser overlap of the bladders. It is distinguished from *C. pallidus* (Reissinger) Couper in lacking the distinct bladder ornamentation of that species and its bladders also appear to be slightly longer and more inclined distally. Like the species mentioned, its affinities are probably with the Caytoniales.

Genus ARAUCARIACITES Cookson

Araucariacites cf. *A. australis* Cookson

Plate 3, Figure 9

Description.—Outline circular or sub-circular, frequently distorted by folding. No germinal mechanism or tetrad markings visible. Diameter (based on 325 measured specimens) 31 to 98 microns (average 55 microns). Exine thin, granulate, with granulations of varying size (up to 1 micron), closely spaced to distinctly separated.

Figured specimens.—(Plate 3, Figure 9); Slide No. 205; Stage coordinates 14·1, 107·4; diameter 55 microns.

Locality.—Bore N.S. 42, 546 ft. 8 in. to 547 ft. 1¾ in.

Remarks.—The Rosewood specimens show considerable variation, both in diameter and in the size and closeness of the granulations. In size range they compare closely with that given by Cookson (1947, p. 130) (39 to 93 microns) but some of the Rosewood specimens, such as that figured (Plate 3, Figure 9) have somewhat larger granulations, which are further apart than in Cookson's figures (1947, Pl. XIII, Figs. 1–4), and consequently the specimens are only compared with *A. australis.* Study of a large number of specimens has shown that there is continuous variation, both in size range and in the nature of the ornamentation, so that no closer grouping of the Rosewood pollens has been possible.

Genus INAPERTUROPOLLENITES Thomson and Pflug

Inaperturopollenites reidi, new species

Plate 3, Figure 7

Diagnosis.—Outline circular or sub-circular, frequently distorted by folding. No germinal mechanism or tetrad markings visible. Diameter (based on 156 measured specimens) 60 to 112 microns (average about 82 microns). Exine smooth, thin (about 1 micron in thickness), frequently folded, light brownish yellow to almost colourless.

Holotype.—(Plate 3, Figure 7); Slide No. 290; Stage coordinates 13·6, 111·9; diameter 110 microns.

Locality.—Bore N.S. 84, 231 ft. 8 in. to 232 ft. 7½ in.

Remarks.—This species is distinguished from *I. limbatus and I. turbatus* described by Balme (1957, p. 31) by its lack of ornamentation, and also by the absence of differential thickening. It also differs from *Araucariacites australis* Cookson in having a smooth exine. There is a general resemblance to the latter species in size range and in the lack of germinal openings which suggests affinity with the Araucariaceae.

Inaperturopollenites reidi is named after the late Mr. J. H. Reid, former District Geologist, Geological Survey of Queensland, who made the first detailed geological survey of the Rosewood coalfield.

Inaperturopollenites sp.

Plate 3, Figure 5

Description.—Outline circular or subcircular, frequently distorted by folding. No germinal mechanism or tetrad markings visible. Diameter (based on 81 measured specimens) 20 to 55 microns (average about 32 microns). Exine smooth, thin (about 1 micron in thickness), frequently folded.

Figured specimen.—(Plate 3, Figure 5); Slide No. 154; Stage coordinates 11·5; 109·1; diameter 30 microns.

Locality.—New Malabar Colliery (1954 tunnel).

Remarks.—Forms described here have been separated from *I. reidi* on the basis of size frequency distribution. The large size range suggests that the description may include more than one species, and consequently no specific name has been given to the specimens. The affinities of these forms are also doubtful; some of the larger specimens resemble pollens of the Araucariaceae, while some of the smaller forms can be compared with the spores of *Equisetum,* as was done by Balme (1957, p. 28) in the case of *Pilasporites marcidus,* a somewhat similar species from Western Australia. In view of the continuous size range and lack of ornamentation and germinal characters to provide a basis for classification, no closer grouping of the Rosewood specimens can be attempted.

Genus ZONALAPOLLENITES Pflug

Zonalapollenites dampieri Balme

Plate 3, Figure 8

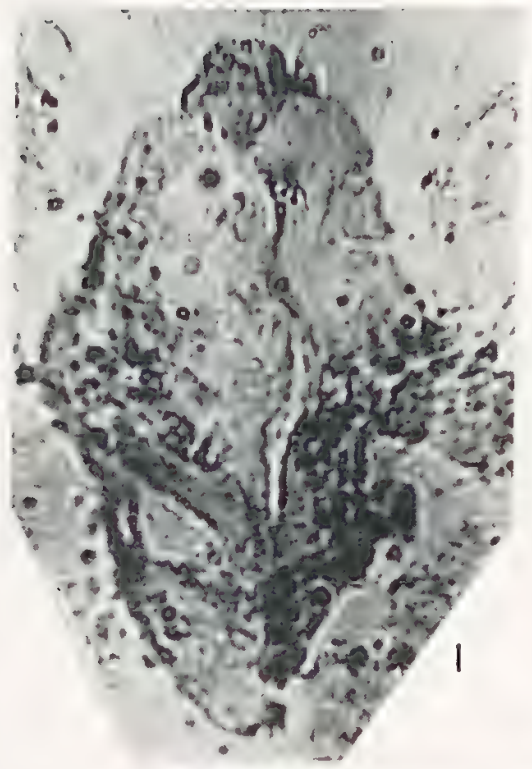
Zonapollenites dampieri Balme, 1957, C.S.I.R.O. Physical and Chemical Survey of the National Coal Resources, Ref. T.C. 25, p. 32, pl. 8, figs. 88-90.

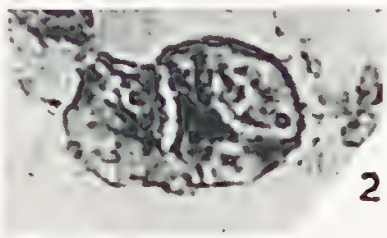
Figured Specimen.—(Plate 3, Figure 8); Slide No. 142; Stage coordinates 16·1, 108·6; diameter 65 microns.

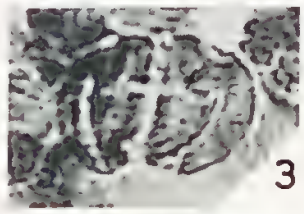
Locality.—Bore N.S. 40, 230 ft. 8¾ in. to 232 ft. 11¼ in.

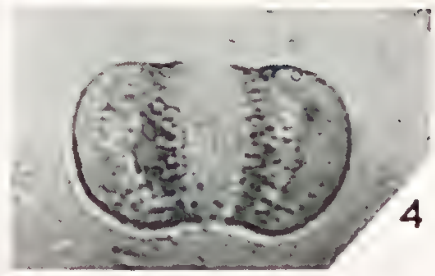
All the photographs are at a magnification of 830 diameters

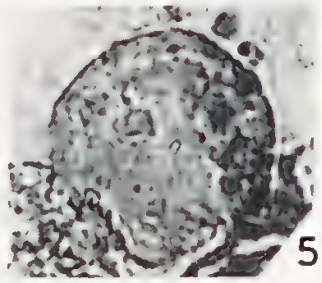
Plate 3

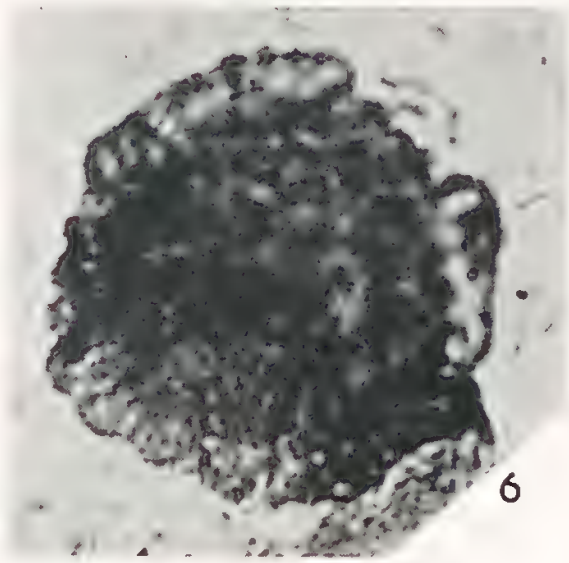


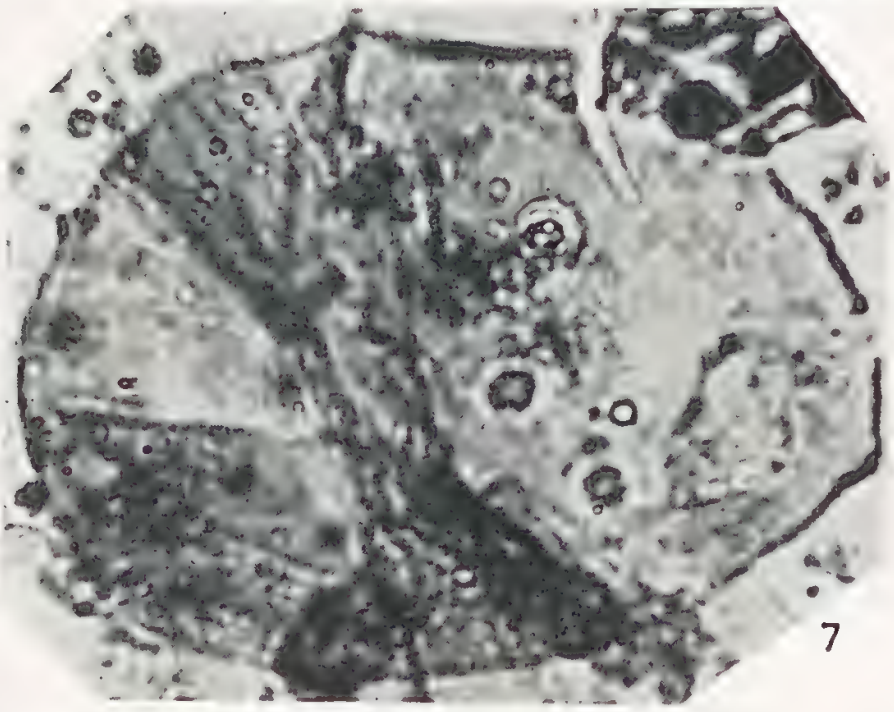


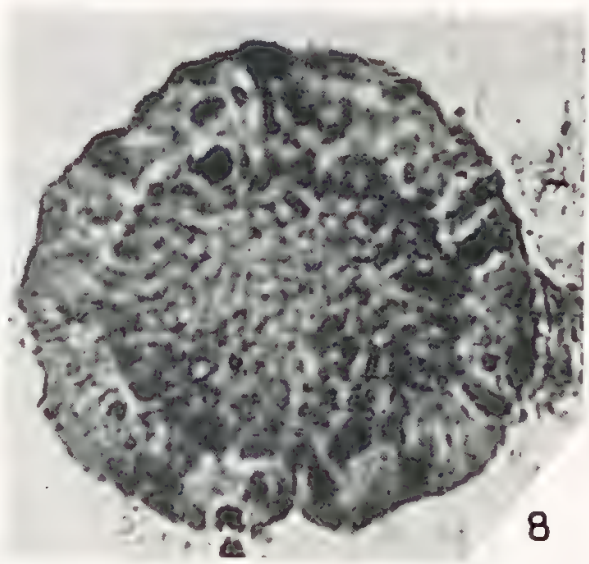


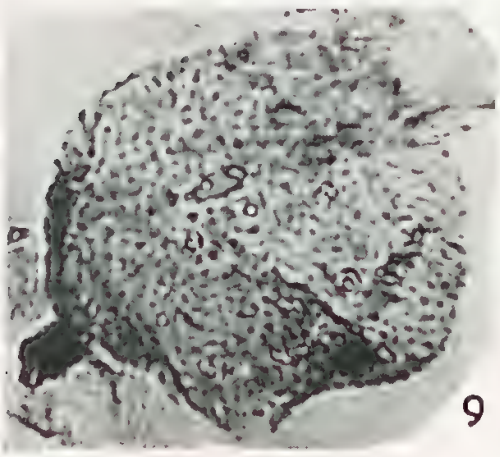


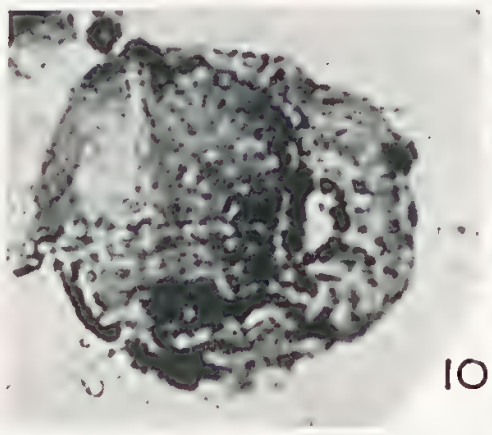












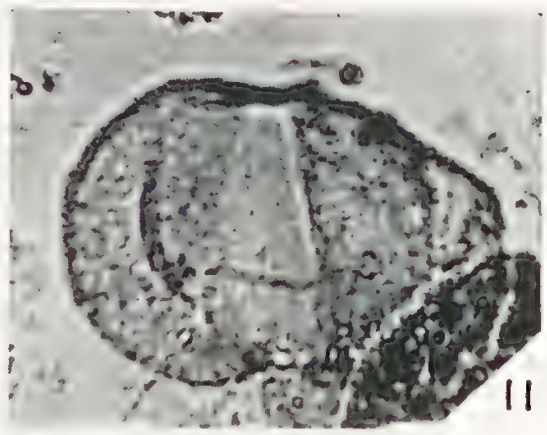


Fig. 1.—*Entylissa magna* n. sp. Holotype.
Fig. 2.—*Caytonipollenites contectus* n. sp. Holotype.
Fig. 3.—*Caytonipollenites contectus* n. sp. Paratype.
Fig. 4.—*Caytonipollenites subtilis* n. sp. Holotype.
Fig. 5.—*Inaperturopollenites sp.*
Fig. 6.—*Zonalapollenites segmentatus* Balme.
Fig. 7.—*Inaperturopollenites reidi* n. sp. Holotype.
Fig. 8.—*Zonalapollenites dampieri* Balme.
Fig. 9.—*Araucariacites* cf. *australis* Cookson.
Fig. 10.—*Pityosporites parvisaccatus* n. sp. Holotype.
Fig. 11.—*Pityosporites psilatus* n. sp. Holotype.

Remarks.—The pollen grains recorded here agree closely with Balme's description, the only additional observation being that in many of the Rosewood specimens the bladders are smooth walled, rather than very finely granulate as in the type material. In preliminary work on the Rosewood specimens they were tentatively classified under the genus *Perotrilites* Couper; however further study has shown that the triradiate markings observed are of a vestigial nature, as in *Zonalapollenites,* rather than functional, as in *Perotrilites.*

Regarding the affinities of this species Balme states (1957, p. 32): "The species is morphologically similar to the pollen grains of certain species of *Tsuga* but is most unlikely to have derived from this, or any closely related, genus. Its frequent occurrence and widespread distribution suggest that it is a tree pollen, perhaps of coniferalean affinities."

Zonalapollenites segmentatus Balme

Plate 3, Figure 6

Zonalapollenites segmentatus Balme, 1957, C.S.I.R.O. Physical and Chemical Survey of the National Coal Resources, Ref. T.C. 25, p. 33, pl. 9, figs. 93-94.

Figured specimen.—(Plate 3, Figure 6); Slide No. 149; Stage coordinates 8·5, 110·9; diameter 57 microns.

Locality.—Bore N.S. 40, 206 ft. 0½ in. to 207 ft. 5¼ in.

Remarks.—Under this species are recorded specimens which agree closely with Balme's diagnosis. Regarding its distribution and relation to Z. *dampieri* Balme states (1957, p. 33): "This species differs from *Zonalapollenites dampieri* in its smaller size, thicker exine, and narrower, more intensely folded bladder. It was fairly common in the Hill River—Jurien Bay sediments, but very rare elsewhere."

Genus PITYOSPORITES Seward

Remarks.—The writer has followed Balme (1957, p. 35) in placing in this form-genus bisaccate pollen grains, lacking characters which clearly differentiate them from Abietineous pollens. Balme considers that the likely affinities of such forms in the Australian Mesozoic and Tertiary are with the Podocarpaceae or Pteridospermae.

Specimens of *Pityosporites* isolated from the Rosewood coals are frequently unexpanded, crumpled or unfavourably exposed, and in addition the genus is not very abundant in any of the samples studied. Consequently it has only been possible to define two species, *P. parvisaccatus* and *P. psilatus* which are described below.

Pityosporites parvisaccatus, new species

Plate 3, Figure 10

Diagnosis.—Pollen grains bilateral, bisaccate. Body of grain broadly elliptical in polar view, length 43 to 80 microns, width 32 to 62 microns (based on 56 measured specimens). Exine of cap smooth to faintly granular, relatively thin (1 to 1·5 microns) no marginal ridge. Sulcus (furrow) psilate to finely granular, without a thickened furrow-rim. Two small air-bladders, sometimes inequal in size, usually shorter than length of grain and with a fine indistinct reticulum. Size range of bladders 33 to 65 microns (length) and 15 to 33 microns (width).

Holotype.—(Plate 3, Figure 10); Slide No. 136; Stage coordinates 11·5, 101·4; length of body 45 microns; width of body 35 microns.

Locality.—Bore N.S. 21, 219 ft. 4 in. to 220 ft. 4¼ in.

Remarks.—The ellipsoidal body, with its thin exine, and the small narrow bladders, distinguish this species from previously described species of *Pityosporites.* There is some resemblance to a specimen figured, but not described, by Cookson (Cookson 1953, plate 2, fig. 42) from the Cretaceous Comaum clays of Victoria, but in the latter specimen the bladders appear to be wider than is normal in *P. parvisaccatus.*

Pityosporites psilatus, new species

Plate 3, Figure 11

Diagnosis.—Pollen grain bisaccate. Total span (based on 29 measured specimens) 50 to 73 microns. Central body circular or sub-circular, proximal cap smooth and relatively thin (less than 1 micron). Diameter of central body 33 to 43 microns. Bladders symmetrically disposed on either side of the furrow (width 10 to 17 microns), extending along its full length, distal inclination slight. Bladders with a fine indistinct internal reticulum (mesh about 1 micron).

Holotype.—(Plate 3, Figure 11); Slide No. 202; Stage coordinates 15·6, 107·8; Total span 57 microns; diameter of body 36 microns.

Locality.—Bore N.S. 42, 528 ft. 6¼ in. to 530 ft. 6¼ in.

Remarks.—This species is somewhat similar to *P. similis* Balme from the Upper Jurassic and Lower Cretaceous of Western Australia, but the exine of the body is smooth, not ornamented as in that species, and the shape and ornamentation of the bladders are also different.

5. Comparison with the Macro-Flora of the Rosewood Coalfield

Although David (1950, p. 465) gives a list of 25 species of fossil plants identified in the Walloon Coal measures and equivalent formations, the majority of these species were collected from localities away from the type area in the Rosewood coalfield. As direct comparison with the microflora must be based on material collected within the area of the coalfield,

such comparison is restricted to the following list, compiled largely from Walkom (1917A, p. 24; 1917B, p. 25) and Reid (1922, p. 19):—

Cladophlebis australis (Morris)
Taeniopteris spatulata (McClelland)
Phyllopteris feistmanteli (Eth. Jr.)
Sphenopteris sp. (?)
Brachyphyllum crassum, Tenison-Woods
?*Thinnfeldia acuta* Walkom
Coniopteris sp.

In the course of the present drilling programme carried out by the Mines Department, shale cores from various horizons in the coal measures have been searched for plant fossils, but well-preserved specimens have proved to be relatively rare. Only one species not already recorded by Reid and Walkom was found in these bore cores; this was a form identified by the writer as *Coniopteris* sp.

Of the above species, *Cladophlebis australis* is considered to have affinities with the Osmundaceae (Walkom 1917A, p. 2). Of the spore species described here, the only one with definite Osmundaceous affinities is *Osmundacidites cf. wellmanii* Couper. This suggests that the spores recorded under this name are either the spores of *Cladophlebis australis* or of some closely related species.

Taeniopteris spatulata is a leaf type known in Queensland from impressions only. Although the evidence of cuticular structure is thus lacking, it seems likely that this species is a member of the Cycadophyta. Pollen grains with probable Cycadophyte affinities are represented by three species of *Entylissa – E. nitidus* Balme and the two new species, *E. magna* and *E. crassimarginis.* One of these species may thus include the pollen of *T. spatulata.*

The genus *Brachyphyllum* comprises conifer stems and foliage, which on the basis of cuticular structure and associated cones, were considered by Kendall (1947) to have Araucarian affinities. On the other hand Bose (1952, p. 294) has shown that the secondary wood of one species (*B. spiroxylum* Bose) resembles that of the Taxineae. In the microflora three species—*Araucariacites* cf. *australis, Inaperturopollenites reidi* and *Inaperturopollenites sp.,* have possible Araucarian affinities, while none of the pollen species have been related to the Taxineae. Thus it seems likely that one of these pollen types may represent the pollen of *Brachyphyllum crassum.*

On the evidence of the fertile fronds the genus *Coniopteris* is now placed in the Dicksoniaceae (Medwell 1954, p. 85). In the microflora there are several species which resemble spores of the Dicksoniaceae and may thus be the spores of the frond type recorded as *Coniopteris sp.* They are: *Cyathidites parvus, Leiotriletes directus, L. magnus, L. mortoni, L. crassus, Granulatisporites minor, Verrucosisporites triangularis* and *V. walloonensis.*

The remaining three species of the macro-flora—*Phyllopteris feistmanteli, ?Thinnfeldia acuta* and *Sphenopteris* sp.—are either doubtful records or forms of which the affinities are uncertain and consequently do not furnish any further evidence on the relationships of the micro – and macro-floras. A comparison of the floras has thus suggested relationships of certain species of spores and pollen to four species based on leaf characters—namely *Cladophlebis australis, Taeniopteris spatulata, Brachyphyllum crassum* and *Coniopteris* sp.

From the preceding account, it is evident that the fossil spores and pollen grains have provided a much more detailed and representative record of the vegetation of the Walloon Coal Measures in the type area than is furnished by the larger plant fossils. This could be expected as a consequence of the abundance of microfossils in the coal seams and the relative rarity of plant impressions in the accompanying sediments.

6. Age and Relationships of the Microflora

Although the Walloon Coal Measures have for many years been regarded as Jurassic in age, there has been insufficient evidence for closer age determination. Drilling in recent years has shown that the productive portion of the coal measures, containing all the workable seams, is only about 500 feet in thickness in the vicinity of Rosewood. Thus it seems highly improbable that such a thin sequence of fresh-water sediments, without any major disconformities, could have required a large part of the Jurassic period for its deposition. Accordingly it was hoped that the investigation of the spore and pollen content of the coals would supply additional evidence on their geological age, and thus enable the formation to be placed within one of the divisions of the Jurassic. Although it cannot be expected that these plant microfossils will ever rival certain marine invertebrates, such as Foraminifera or Ammonites, for accuracy as index fossils, their value in correlating fresh-water sediments is now well established, and they have already provided further evidence on the age of these coal measures, which is summarised below.

A study of recent papers describing the stratigraphical applications of plant microfossils, for example, those of Couper (1953) and Balme (1957) indicates that many spore and pollen genera have ranges extending through one or more geological periods, and that species, rather than genera, are the Key fossils for correlation purposes. Of the forty species distinguished in the present investigation, twenty-eight are new, and thus of little value in correlation, while the remaining twelve have been identified or compared with species recorded from Mesozoic formations in Western Australia, New Zealand and Poland.

The most useful reference succession for correlation is provided by the microfloras described by Balme (1957, pp. 40-44) from the Mesozoic of Western Australia. These microfloras are accurately dated from the evidence of marine fossils in sediments interbedded with the strata containing the plant microfossils and their sequence extends from Lower Jurassic to Aptian. The species which also occur in the Walloon Coal Measures have the following distribution in this sequence:—

(1) *Zonalapollenites segmentatus* has been recorded from the Lower Jurassic, with doubtful specimens from the Bajocian, Oxfordian and Kimeridgian.

(2) *Zonalapollenites dampieri* ranges from Bajocian to Aptian, with doubtful specimens from the Lower Jurassic.

(3) The species *Sphagnumsporites australis, Entylissa nitidus* and *Araucariacites australis* range throughout the Western Australian sequence.

(4) *Sphagnumsporites clavus* is restricted to the Neocomian and Aptian. However Balme suggests (1957, pp. 15, 43) that such Bryophyte spores may be markedly affected in their distribution by facies changes, so that relatively little importance should be attached to the presence or relative abundance of this species, which may ultimately prove to be as long-ranged as *Sphagnumsporites australis.*

The distribution of these species, particularly the occurrence of the distinctive *Zonalapollenites segmentatus,* favours a Lower Jurassic age for the Walloon Coal Measures in the type area. This correlation is supported by the presence of the genus *Annulispora,* which in certain morphological features resembles *Exesipollenites* Balme, a genus restricted to and characteristic of the Lower Jurassic in Western Australia. Certain differences observed between the Western Australia and Queensland assemblages may reflect facies differences, as investigation of the Walloon Coal Measures has so far been confined to the coal seams, while a wider range of lithological types has been examined in Western Australia. Further work in both States may thus indicate a closer relationship between the microfloras.

A comparison with the microfloras of the Hawks Crag Breccia and Ohika Beds of New Zealand (see Couper 1953, pp. 9, 10) does not assist further in age determination, as these formations have not been definitely placed in any of the divisions of the Jurassic. One of the New Zealand species—*Leptolepidites verrucatus* Couper—has been identified in the Rosewood coals, while the following comparisons have been made:—*Araucariacites cf. australis* Cookson, *Entylissa nitidus* Balme, *Osmundacidites cf. wellmanii* Couper, *Sphagnumsporites australis* (Cookson), all from the Walloon Coal Measures, resemble respectively in many features *Araucariacites cf. australis* Cookson, *Monosulcites aff. minimus* Cookson, *Osmundacidites wellmanii* Couper and *Sphagnum sp.* Couper from the New Zealand formations. Distinctive Lower Jurassic forms such as *Zonalapollenites segmentatus* and *Exesipollenites* appear to be missing from the New Zealand microfloras and this suggests that the latter may be somewhat younger (Middle or Upper Jurassic).

The principal feature the Walloon microflora has in common with the Liassic assemblage from Poland described by Rogalska (1954) is the occurrence of the species *Annulispora folliculosa* (Rogalska). The discovery of this distinctive spore in the Queensland samples is further evidence for a Lower Jurassic age.

The present position regarding the age of the Walloon Coal Measures in the type area is thus that the available evidence from the spore and pollen assemblage favours a Lower Jurassic age. Insufficient information is at present available to determine the age of the underlying Marburg Sandstone, as only one sample from it has so far been examined, but from the absence of a major time break between it and the coal measures this formation is likely to be either Lower Jurassic or Upper Triassic.

7. Acknowledgements

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SPORE DISTRIBUTION AND CORRELATION IN THE ROSEWOOD COALFIELD

By N. J. de Jersey, Ph.D., M.Sc., Research Geologist

Abstract

This report describes the distribution of forty species of spores and pollen (described morphologically in a previous report) in the Jurassic coal seams of the Rosewood district. The investigation was based on over one hundred coal samples, derived both from colliery workings and from bore cores, attention being concentrated on the thicker, more persistent seams. It was found that most of the more abundant species range through the succession without significant changes in percentage distribution. However detailed study of species distribution has shown that seven of the less common species are of correlative value. Such species, which have been designated "Key species," show significant changes in vertical distribution, and the evidence indicates that the distribution patterns are persistent laterally for these species. The use of these "Key species" in correlation of the major seams is described in detail, and for each of these major seams a table showing the percentages of all species in the assemblage is included. The results indicate that the spore assemblage should enable an unknown seam to be identified, or to be placed in a fairly restricted portion of the succession. In general terms the investigation has indicated the percentage composition of the microflora of the Walloon Coal Measures in the type area. It should thus serve as a basis for comparison with microfloras from strata of similar age, particularly in the Artesian Basin.

1. Introduction

In a previous report (de Jersey 1958b) forty species of spores and pollen grains from the Jurassic coal seams of the Rosewood district have been described and illustrated by photographs. The percentage distribution of these species has now been determined in over one hundred samples from this coalfield and the purpose of the present report is to record their distribution in the principal seams and to discuss the application of spore distribution to seam correlation.

Correlation problems in this coalfield which, in the first place, prompted the investigation, have arisen from such factors as lack of outcrops, rarity of reliable marker beds, and marked variation in seam sections, and at the time of Reid's reports (1922, 1927) correlation of seams, even from one colliery to the next, was difficult and uncertain. In recent years, however, an extensive diamond drilling programme has been carried out by the Queensland Department of Mines, and as a result numerous long vertical sections have become available for comparison. The purpose of this diamond drilling has been to determine reserves in seams being worked in areas adjacent to existing collieries, and also to test seams lower or higher in the sequence than those being exploited. Drilling in a closely-spaced grid (i.e., with bores from 10 to 15 chains apart) has in most cases enabled correlation of seams within the individual mine areas, and consequently in the early stages of the work spore correlation studies were undertaken to extend the correlation from one mine area to the next. In recent years, with further drilling in the intervening areas the gaps between the various mine areas have been largely filled in with bores similarly spaced, so that the only areas now isolated from this pattern of bores are the Smithfield No. 3, Mount Elliott, and Moorefield No. 3 mine areas. This recent drilling has, in general, supported the results of the earlier spore distribution studies.

In general one bore was taken as representative of each mine area studied, the spore assemblages being normally investigated for all coal sections, more than six inches in thickness. Preliminary reports, giving detailed results from the aspect of correlation, have already been submitted for several of the mine areas (de Jersey 1955a, 1955b, 1957a, 1958a). One conclusion which has emerged from both the spore correlation studies and comparison of the succession in bore sequences is that several seams in the coalfield are more extensive than previously believed. In earlier years, owing to difficulties in correlation and to marked variation in seam sections, the seams were generally regarded as rather lenticular, but the evidence is now clear that at least some of the seams, although varying considerably in thickness and section, can be traced as coal horizons over large areas of the coalfield. Thus the concept of lenticularity applies only to areas of workable coal and the seams, as coal horizons, are far more persistent than previously believed. Between these relatively persistent seams are others, usually thinner, less persistent and more variable in thickness. The spore distribution studies described below have been concentrated on the thicker, more persistent seams in order to determine their characteristic spore assemblages and to examine their possible use in correlation.

2. Experimental Method

The coal samples studied were derived from two sources—channel samples collected in colliery workings and cores obtained in the diamond drilling programme of the Queensland Mines Department which began in 1952 in this coalfield, and is still in progress. Each sample was first crushed to approximately quarter-inch screen size and sampled by conventional quartering methods; the coal was then further crushed down to minus 20 mesh and again sampled, dust and finely-divided coal being removed by screening through a 40-mesh sieve. Shale and shaley coal were then removed as the sinks in carbon tetrachloride (specific gravity 1·58); the float fraction consisting of relatively clean coal (average ash approximately 10 per cent.). After air-drying 4 gm. of this final sample was taken for maceration. A period of 16-17 hours was found suitable for maceration with potassium chlorate and nitric acid, which was carried out by a technique similar to that previously described (de Jersey 1946, p. 2).

Three micro-slides were prepared from the maceration residue for each sample, 500 specimens being examined in each case by traversing the slides systematically with the aid of a mechanical stage. Throughout the maceration process, the samples were treated in a standardised manner, so that results from different samples would be strictly comparable.

3. Spore and Pollen Species and their Vertical Distribution

Spore distribution studies have been made on the basis of the percentages of the forty species recently described from this coalfield (de Jersey 1958b). One result of this taxonomic work was to indicate that the tentative designations given to some of the genera and species in the preliminary reports mentioned above had to be modified on account of work published since preparation of the earlier reports. The list of species recorded is as follows (de Jersey 1958b, pp. 2-17):—

Sphagnumsporites australis (Cookson) Potonié
Sphagnumsporites clavus (Balme) de Jersey MS.
Sphagnumsporites tenuis de Jersey MS.
Sphagnumsporites adnatus de Jersey MS.
Lycopodium rosewoodensis de Jersey MS.
Lycopodium triangularis de Jersey MS.
Osmundacidites cf. *wellmanii* Couper
Gleichenia cf. *circinidites* Cookson
Cyathidites parvus de Jersey MS.
Leptolepidites verrucatus Couper
Leiotriletes directus Balme and Hennelly
Leiotriletes magnus de Jersey MS.
Leiotriletes mortoni de Jersey MS.
Leiotriletes crassus de Jersey MS.
Granulatisporites minor de Jersey MS.
Cyclogranisporites breviradiata de Jersey MS.
Punctatisporites crassiradiata de Jersey MS.
Punctatisporites minimus de Jersey MS.
Verrucosisporites walloonensis de Jersey MS.
Verrucosisporites triangularis de Jersey MS.
Acanthotriletes pallidus de Jersey MS.
Rugulatisporites ramosus de Jersey MS.
Cingulatisporites granulatus de Jersey MS.
Annulispora folliculosa (Rogalska) de Jersey MS.
Annulispora densata de Jersey MS.
Pilasporites minutus de Jersey MS.
Pilasporites crassus de Jersey MS.
Marsupipollenites psilatus de Jersey MS.
Entylissa nitidus Balme
Entylissa crassimarginis de Jersey MS.
Entylissa magna de Jersey MS.
Caytonipollenites contectus de Jersey MS.
Caytonipollenites subtilis de Jersey MS.
Araucariacites cf. *australis* Cookson
Inaperturopollenites reidi de Jersey MS.
Inaperturopollenites sp.
Zonalapollenites dampieri Balme
Zonalapollenites segmentatus Balme
Pityosporites parvisaccatus de Jersey MS.
Pityosporites psilatus de Jersey MS.

As this report (de Jersey 1958b) is still unpublished at the time of writing (June 1959) the new species and new combinations proposed in it have as yet no taxonomic standing and accordingly such species have been distinguished in the above list by the term "de Jersey MS." In addition since this report was written the use of the names of present-day genera for Mesozoic species has been largely discontinued in palynological work, so that it will probably be desirable to transfer the species described under *Lycopodium* and *Gleichenia* to the genera *Lycopodiumsporites* and *Gleicheniidites* respectively.

The percentage distribution of the above species in the vertical seam succession is best exemplified by the results from examination of the coal cores from Bore N.S. 42. This bore was drilled in the Oakleigh mine area, in a relatively central position in the coalfield (see locality map—Figure 1), and was the first bore to penetrate the complete succession of seams in the productive portion of the coal measures. Consequently it was selected for detailed study of spore distribution, and nineteen samples, representing all the coal sections of significant thickness, were examined. The percentages of the various species, as determined for each of these samples, are listed below in Table 1.

TABLE 1

PERCENTAGE DISTRIBUTION OF SPECIES IN COAL SECTIONS IN BORE N.S. 42

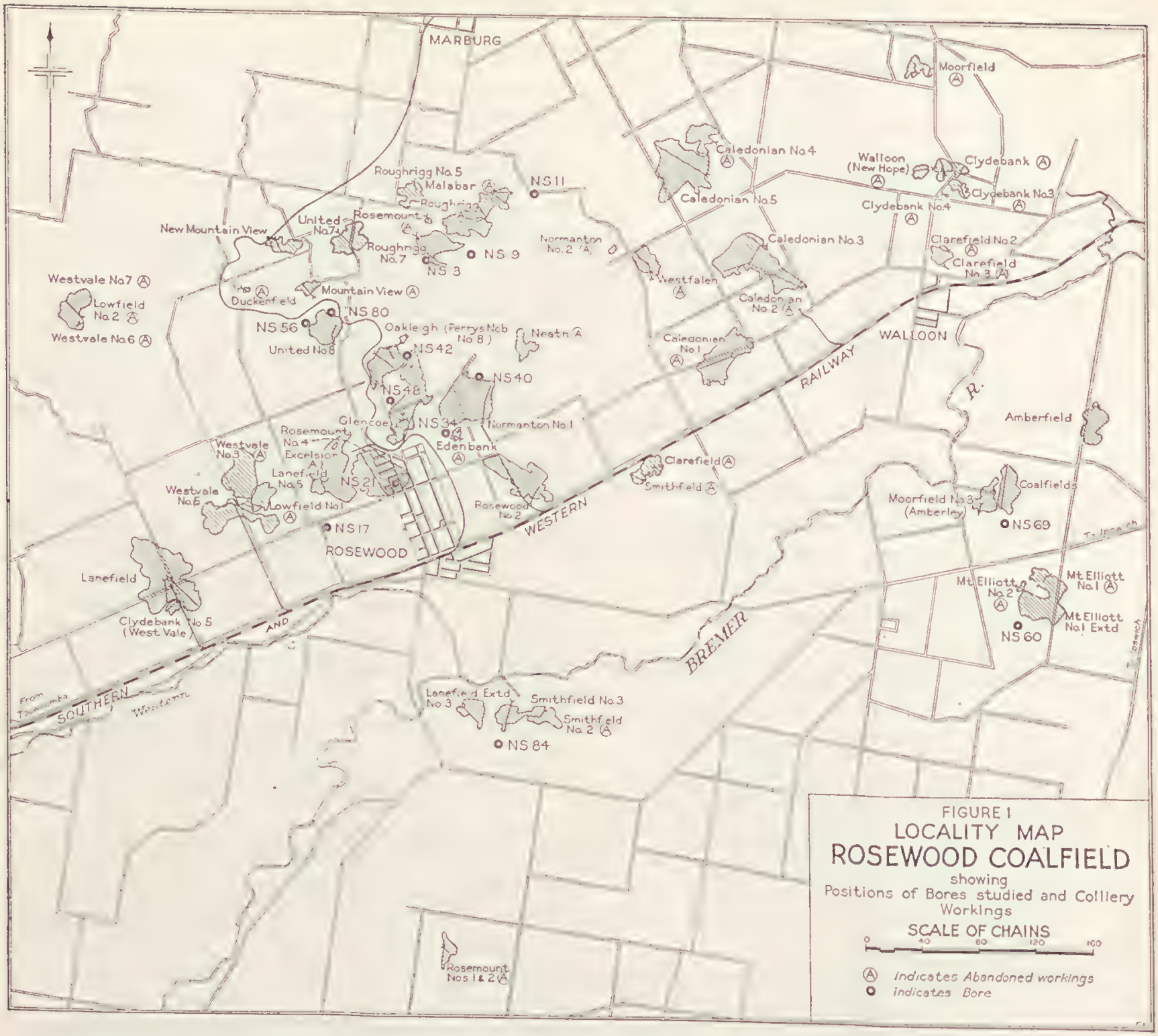
Coal Sections (Excluding Shale Bands)

Species	176 ft. 6¼ in.–178 ft. 3¼ in.	194 ft. 10 in.–203 ft. 4 in.	205 ft. 9 in.–208 ft. 9½ in.	209 ft. 9 in.–212 ft. 1½ in.	213 ft. 2½ in.–214 ft. 11½ in.	230 ft. 10 in.–231 ft. 9 in.	294 ft. 4½ in.–298 ft. 11 in.	326 ft. 4 in.–327 ft. 10 in.	406 ft. 0¾ in.–408 ft. 11 in.	411 ft. 9¼ in.–413 ft. 2¾ in.	455 ft. 10 in.–460 ft. 7½ in.	465 ft. 9½ in.–468 ft. 8¾ in.	484 ft. 1 in.–487 ft. 0¼ in.	512 ft. 9¾ in.–514 ft. 2 in.	515 ft. 7¼ in.–522 ft. 1¾ in.	528 ft. 6¼ in.–530 ft. 6¼ in.	546 ft. 8 in.–547 ft. 1¾ in.	579 ft. 5¼ in.–580 ft. 8¾ in.	637 ft. 10¾ in.–645 ft. 8¾ in.
Sphagnumsporites australis	0·2	0·8	1·0	0·6	0·2	0·2	A	0·4	A	0·8	0·2	0·4	0·4	0·2	0·2	0·4	0·2	0·4	0·2
Sphagnumsporites clavus ..	A	0·2	A	A	A	A	A	0·2?	0·2	A	A	0·4	A	0·2	0·6	A	A	A	A
Sphagnumsporites tenuis ..	0·2	0·6	0·4	0·4	0·2	0·2	0·4	0·4	A	1·0	1·0	1·2	0·4	0·4	0·4	0·2	0·4	0·8	0·8
Sphagnumsporites adnatus ..	0·6	0·8	0·4	0·2	A	0·8	0·4	1·0	0·4	0·6	0·8	0·6	0·8	0·4	0·8	0·8	1·4	0·8	0·2
Lycopodium rosewoodensis ..	0·6	1·8	2·4	3·6	2·6	3·0	3·6	6·2	9·8	6·2	1·8	4·8	2·0	10·0	5·2	5·6	6·4	5·6	6·8
Lycopodium triangularis ..	A	0·2	A	0·4	0·2	A	0·4	0·8	0·8	0·2	1·0	0·4	0·4	0·4	A	0·2	1·6	0·4	0·4
Osmundacidites cf. *wellmanii* ..	A	0·2	A	A	0·2	A	0·2	0·2	A	A	0·4	0·4	A	0·4	A	0·2	A	0·6	0·4
Gleichenia cf. *circinidites* ..	0·2	1·0	0·4	1·6	2·0	0·2	0·2	0·6	0·2	A	A	3·4	0·2	3·8	A	1·4	A	0·4	A
Cyathidites parvus ..	0·2	0·4	0·8	0·4	0·2	A	0·6	0·4	0·2	A	0·2	0·8	0·8	0·2	0·6	0·4	0·2	0·2	0·2
Leptolepidites verrucatus ..	A	0·4	0·6	·0·2?	A	0·2	A	0·8	1·2	1·2	0·6	0·4	0·2	1·4	0·8	0·6	A	1·4	0·6
Leiotriletes directus ..	17·0	17·6	20·4	23·8	20·0	20·4	15·8	12·8	17·4	12·6	12·0	16·2	13·0	20·8	15·4	13·6	15·4	18·0	16·4
Leiotriletes magnus ..	3·0	1·4	0·8	0·8	1·6	1·0	1·6	1·6	1·2	2·0	1·8	0·6	1·6	0·8	2·4	1·0	1·6	0·4	1·6
Leiotriletes mortoni ..	A	A	0·2	0·2	0·2	A	0·2	0·2	0·2	0·2	0·4	0·4	0·2	0·4	A	A	A	0·2	0·8
Leiotriletes crassus ..	0·2	A	A	A	A	A	A	A	A	A	A	A	A	A	0·2	0·2	A	0·4	0·8
Granulatisporites minor ..	0·4	0·4	0·2?	A	0·6	0·6	1·0	A	0·4	0·4	0·6	A	1·4	A	1·2	1·2	1·4	0·8	1·0
Cyclogranisporites breviradiata ..	0·4	0·4	A	0·2	0·2	A	0·2?	A	0·8	0·2	0·2	0·2	0·4	A	0·2	0·2	0·4	0·6	0·2
Punctatisporites crassiradiata ..	0·2	A	A	0·2	0·2	A	A	A	0·2	0·2	0·2	0·2	A	0·2	A	A	A	A	A
Punctatisporites minimus ..	A	A	0·2	A	A	A	A	A	0·4	0·4	0·4	A	0·8	0·2	A	0·4	1·2	0·2	1·2
Verrucosisporites wallonensis ..	0·6	1·0	1·8	0·6	0·4	1·0	0·6	1·2	0·8	1·6	1·0	0·6	0·6	0·8	1·2	1·0	2·8	3·6	1·8
Verrucosisporites triangularis ..	0·2	A	A	A	A	A	A	0·4	0·6	0·4	A	A	0·2	A	0·2	A	0·8	0·4	0·2
Acanthotriletes pallidus ..	A	A	A	0·2	0·2	0·2	A	0·2	0·2	A	A	0·2?	0·8	0·2	0·2	0·2	A	A	0·2
Rugulatisporites ramosus ..	A	0·2	0·2	A	0·2	0·2	A	0·2	0·4	A	A	A	A	A	0·4	A	0·2	0·2	A
Cingulatisporites granulatus ..	A	A	A	A	0·4	A	A	A	A	A	A	A	A	0·6	0·2	A	A	A	A
Annulispora folliculosa ..	1·4	1·4	2·6	2·4	1·6	2·0	1·6	5·0	3·0	1·6	0·8	1·0	0·6	1·2	0·8	1·0	2·0	1·6	1·6
Annulispora densata ..	0·4	0·2	0·4	A	A	0·8	0·8	0·8	0·4	0·2	0·2	A	A	0·2	A	0·2	0·2	0·2	0·4
Pilasporites minutus ..	3·0	4·6	4·8	3·2	2·6	1·2	0·8	2·2	2·4	2·0	2·8	0·8	2·8	1·6	2·4	2·0	2·0	2·4	3·8
Pilasporites crassus ..	0·2	0·2	0·8	0·4	0·2	A	A	1·0	0·8	0·6	0·2	A	1·0	A	0·2	A	0·4	0·4	0·6
Marsupipollenites psilatus ..	A	0·2	A	A	A	A	A	0·4	A	0·2	0·2	0·4	0·2	0·2	A	A	A	A	A
Entylissa nitidus ..	5·6	4·0	7·8	4·6	9·6	8·2	6·6	7·2	3·8	1·4	6·8	1·2	5·6	2·6	4·4	3·2	4·6	4·8	5·2
Entylissa crassimarginis ..	0·4	0·6	1·0	1·0	0·2	0·4	0·6	0·8	0·8	0·8	0·6	0·2	A	0·4	1·0	0·6	0·8	0·2	0·8
Entylissa magna ..	0·8	0·2	0·2	0·4	0·6	0·8	0·2?	A	0·4	0·2	0·8	0·2?	0·2	0·2	0·2	0·2	A	A	0·6
Caytonipollenites contectus ..	A	0·2	A	0·2	A	A	A	0·2	0·2	2·4	1·6	0·8	1·8	3·0	1·2	0·8	0·4	0·8	1·0
Caytonipollenites subtilis ..	A	A	A	A	A	0·2	A	A	A	1·4	0·8	0·6	1·4	1·0	A	0·6	0·2	0·4	0·4
Araucariacites cf. *australis* .. .. }	45·0	33·2	29·2	31·4	32·4	38·5	45·2	30·6	30·8	42·0	39·4	49·4	37·2	30·6	35·0	35·8	24·4	21·8	16·0
Inaperturopollenites reidi .. .. }	4·6	4·6	4·0	3·4	4·8	3·8	5·0	4·2	2·8	4·4	4·6	3·6	2·8	2·8	1·6	1·2	2·6	3·8	2·6
Inaperturopollenites sp. ..	A	0·4	0·2	0·2	A	A	A	0·6	A	0·4	0·2	A	A	A	0·2	A	A	0·2	0·4
Zonalapollenites dampieri ..	A	0·8	A	0·2	0·2	0·2	0·2	0·4	A	0·2	A	A	0·6	A	A	0·2	0·2	A	0·2
Zonalapollenites segmentatus ..	0·2	0·4	0·6	0·4	0·2	0·4	0·4	0·4	0·6	0·2	0·6	0·2	0·2	0·2	0·4	0·4	0·6	0·2	0·2
Pityosporites parrisaccatus ..	A	A	A	A	0·6	A	0·2	0·2	A	A	A	A	A	A	A	0·8	A	A	A
Pityosporites psilatus ..	14·4	21·6	12·6	18·8	17·4	15·5	13·2	18·4	18·6	14·0	19·8	10·4	21·2	15·2	22·2	15·4	17·2	19·0	32·2
Others																			

(1) "A" denotes absent in a count of 500 spores.

(2) "Others" includes spores too poorly preserved for specific identification and determined generically only.

(3) The combined percentages of *Araucariacites* cf., *australis* and *Inaperturopollenites reidi* are given as when spore counts were made on samples from this bore the two species had not been distinguished.



Examination of Table 1 indicates that relatively few species show significant vertical changes in distribution in the succession. This is particularly noticeable for the more abundant forms, such as *Leiotriletes directus* and for the combined proportions of *Araucariacites* cf. *australis* and *Inaperturopollenites reidi*. However, critical examination of the percentage distribution of the less abundant species, for both N.S. 42 and other bores, shows that seven species show changes in abundance in the vertical sequence, which may be of stratigraphical significance. These species are:— *Sphagnumsporites clavus, Leiotriletes crassus, Cingulatisporites granulatus, Caytonipollenites contectus, Caytonipollenites subtilis, Zonalapollenites dampieri,* and *Zonalapollenites segmentatus*.

The percentage distribution of these "Key species" in the coal sections in Bore N.S. 42 has been plotted diagrammatically in Figure 2. In this diagram the distribution patterns are based on the coal sections only, and thicknesses of the seams have been neglected in relation to the (usually) greater intervals between the seams. The stratigraphical significance of the Key species can be summarised as follows:—

(*a*) *Sphagnumsporites clavus*.—*S. clavus* reaches a maximum in the coal section at 515 ft. 7¼ in. in N.S. 42, being rare or absent in most other sections, and has consequently been studied as a Key species for recognition of this horizon.

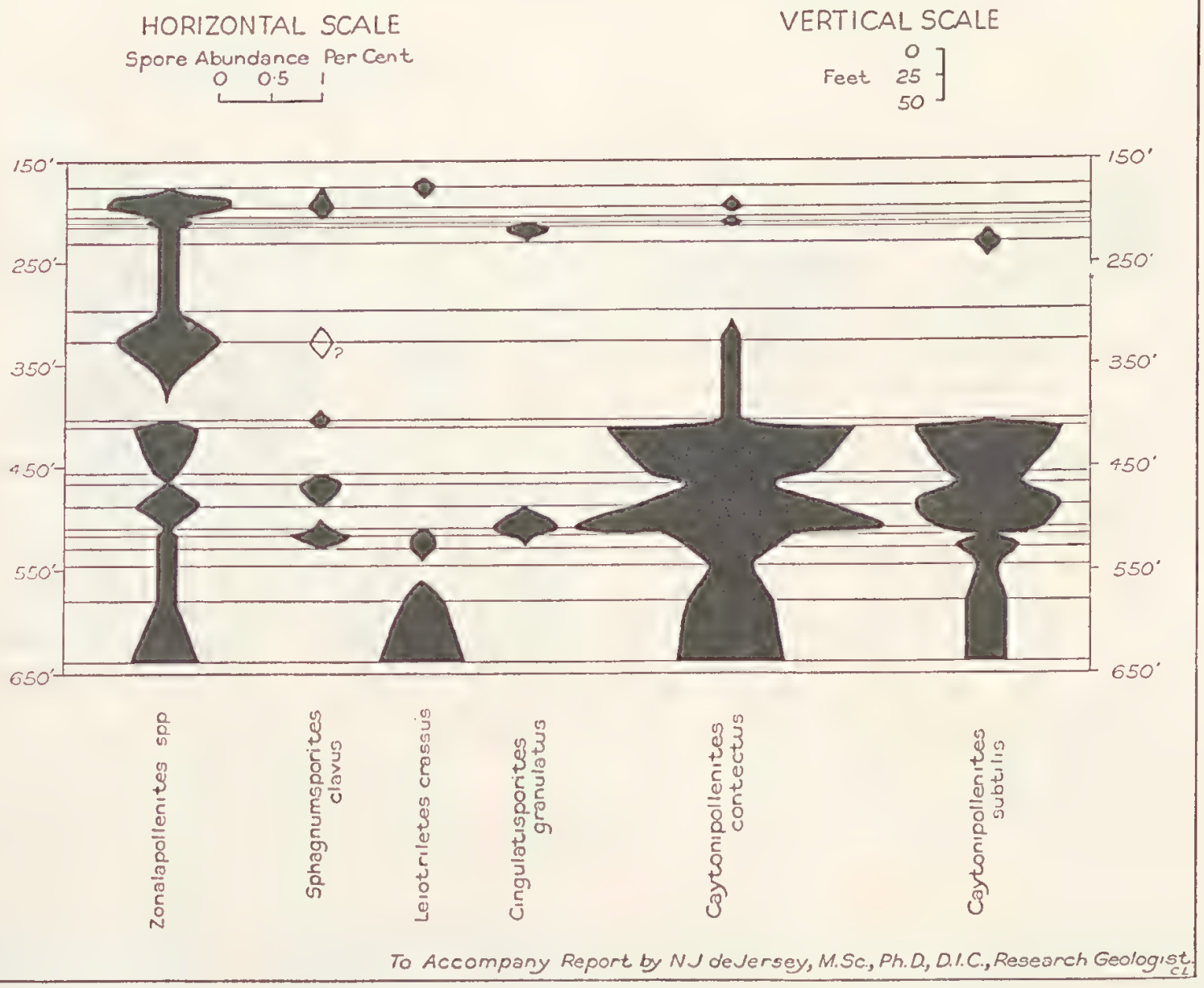
(*b*) *Leiotriletes crassus*.—This species is rare or absent at all horizons except the lowest seam in the sequence, where its proportion is 0·8 per cent. It may thus be of correlative value in recognising this seam.

(*c*) *Cingulatisporites granulatus*.—This species is absent from all except three coal horizons in N.S. 42. Its maximum in the section from 512 ft. 9½ in. to 514 ft. 2 in. is thus of possible value in correlation.

(*d*) *Caytonipollenites contectus*.—*C. contectus* is rare or absent at all coal horizons above the section at 411 ft. 9¼ in. in this bore. In this, and lower sections, its proportion is significantly higher, ranging up to a maximum of 3·0 per cent. The percentages of the species in the seam assemblages accordingly

FIGURE 2

Diagrams showing distribution of Key Species in Coal Sections in Bore N.S.42. Rosewood Coalfield



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provide a means for distinguishing the seams in the upper portion of the coal measures from those in the lower portion. In addition the sharp change from 2·4 per cent. in the section at 411 ft. 9¼ in. to only 0·2 per cent. in the section at 406 ft. 0¾ in., provides a means of recognising, as a marker bed, the shale beds between these two coal sections.

(*e*) *Caytonipollenites subtilis.*—This species follows, in general, a similar pattern in its vertical distribution to that of *C. contectus,* so that the general stratigraphical conclusions drawn from the distribution of that species apply equally to *C. subtilis.* The only exception noted is in the section from 515 ft. 7¼ in. to 522 ft. 1½ in. in which it is absent, while the proportion of *C. contectus* is 1·2 per cent.

(*f*) *Zonalapollenites dampieri* and *Z. segmentatus.*—These two species have, in general, a similar pattern of distribution and their proportions have been combined for representation in Figure 2. These combined proportions suggest the use of the genus as a Key form for two horizons in N.S. 42—represented by the seams at 194 ft. 10 in. and 326 ft. 4 in. in which the proportion of *Zonalapollenites* is 1 per cent. or more. At most other horizons the genus is relatively rare or absent.

To be of definite value in correlation, Key species should show not only significant changes in percentage distribution in the vertical sequence, but also the distribution pattern should be persistent when the horizons are traced laterally. The distribution pattern in the vertical sequence has been summarised above for each of the Key species; such distribution patterns have been shown to be relatively persistent both by comparison of assemblages from the same seam in different localities and comparison of vertical sequences of spore assemblages from different areas of the coalfield. This lateral persistence in the relative proportions of the Key species, and its use in correlation, is discussed below for each of the principal seams in the succession.

4. Spore Assemblages in the Principal Seams and Their Use in Correlation

(i) Introduction

In this section the spore assemblages of the coal seams are described in ascending stratigraphical order, i.e., in order of deposition. One difficulty that has

arisen in the systematic description of the seams is that several of them have not as yet been definitely named. In such cases the headings have been based on the names of collieries working the relevant seams, e.g., the "Westvale No. 5 seam" or else on other features of stratigraphical significance, e.g., the "Unnamed (Bottom) Seam" which is the lowest persistent seam in the Walloon Coal Measures in the Rosewood district. At the present time a detailed investigation of the stratigraphy of the coalfield is being carried out by Mr. J. B. Cameron, Geologist, Geological Survey of Queensland, on the basis of the results of the drilling programme of the Queensland Department of Mines. The results of this investigation will not be anticipated here except to state that such problems of seam nomenclature should be cleared up as a result of Mr. Cameron's work.

(ii) Coal seam in the Marburg Sandstone

This thin seam is the lowest stratigraphically, to be studied in this investigation. It was intersected between 840 ft. 3¼ in. and 840 ft. 6¼ in. in Bore N.S. 56, drilled in the United No. 8 mine area (see locality map—Figure 1). According to J. B. Cameron (Verbal communication), its horizon is approximately 400 feet below the junction between the Marburg Sandstone and the overlying Walloon Coal Measures. The spore assemblage of this seam is given in Table 2.

TABLE 2

Percentage Distribution of Species in Sample from Bore N.S. 56, 840 ft. 3¼ in. to 840 ft. 6¼ in.

Species	Percentage
Sphagnumsporites australis	A
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	A
Sphagnumsporites adnatus	0·2
Lycopodium rosewoodensis	0·4
Lycopodium triangularis	A
Osmundacidites cf. *wellmanii*	A
Gleichenia cf. *circinidites*	A
Cyathidites parvus	1·0
Leptolepidites verrucatus	A
Leiotriletes directus	12·2
Leiotriletes magnus	4·2
Leiotriletes mortoni	0·2
Leiotriletes crassus	0·2
Granulatisporites minor	1·6
Cyclogranisporites breviradiata	0·2
Punctatisporites crassiradiata	A
Punctatisporites minimus	0·6
Verrucosisporites walloonensis	A
Verrucosisporites triangularis	A
Acanthotriletes pallidus	A
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	A
Annulispora densata	A
Pilasporites minutus	2·2
Pilasporites crassus	0·4
Marsupipollenites psilatus	A
Entylissa nitidus	2·2
Entylissa crassimarginis	0·2
Entylissa magna	0·4
Caytonipollenites contectus	A
Caytonipollenites subtilis	0·2
Araucariacites cf. *australis*	9·4
Inaperturopollenites reidi	40·6
Inaperturopollenites sp.	2·2
Zonalapollenites dampieri	0·4
Zonalapollenites segmentatus	A
Pityosporites parvisaccatus	0·4
Pityosporites psilatus	A
Others	24·6

This assemblage is similar to those of seams in the overlying Walloon Coal Measures in the dominance of the two species *Inaperturopollenites reidi* and *Leiotriletes directus*. The main difference from the higher coal seams is that the microflora is relatively impoverished in the number of species, in that several species present in small proportions in the Walloon Coal Measures are absent. This may be related to the relative thinness of the seam, which suggests that the time required for the development of a more varied flora may have been lacking. That this explanation accounts for the absence of at least one genus, rather than its absence being of stratigraphical importance, is indicated by the absence of *Annulispora*. This genus is known to be present in the considerably older Ipswich Coal Measures, so that the plants producing it were likely to have been represented in the flora of the intervening Marburg Sandstone. While several species from the Walloon Coal Measures are thus lacking in the microflora, the assemblage does not contain any species in significant proportions which do not occur in the Walloon Coal Measures.

The conclusion drawn from examination of this assemblage is thus that, while one sample from such a thin seam cannot be considered as fully representative of the Marburg Sandstone, there is a general similarity to the microflora of the overlying Walloon Coal Measures. This Marburg spore assemblage is definitely much closer in general character to the Walloon microflora than it is to the microflora of the Ipswich Coal Measures, and this suggests that there was no major time break between the Marburg Sandstone and the Walloon Coal Measures.

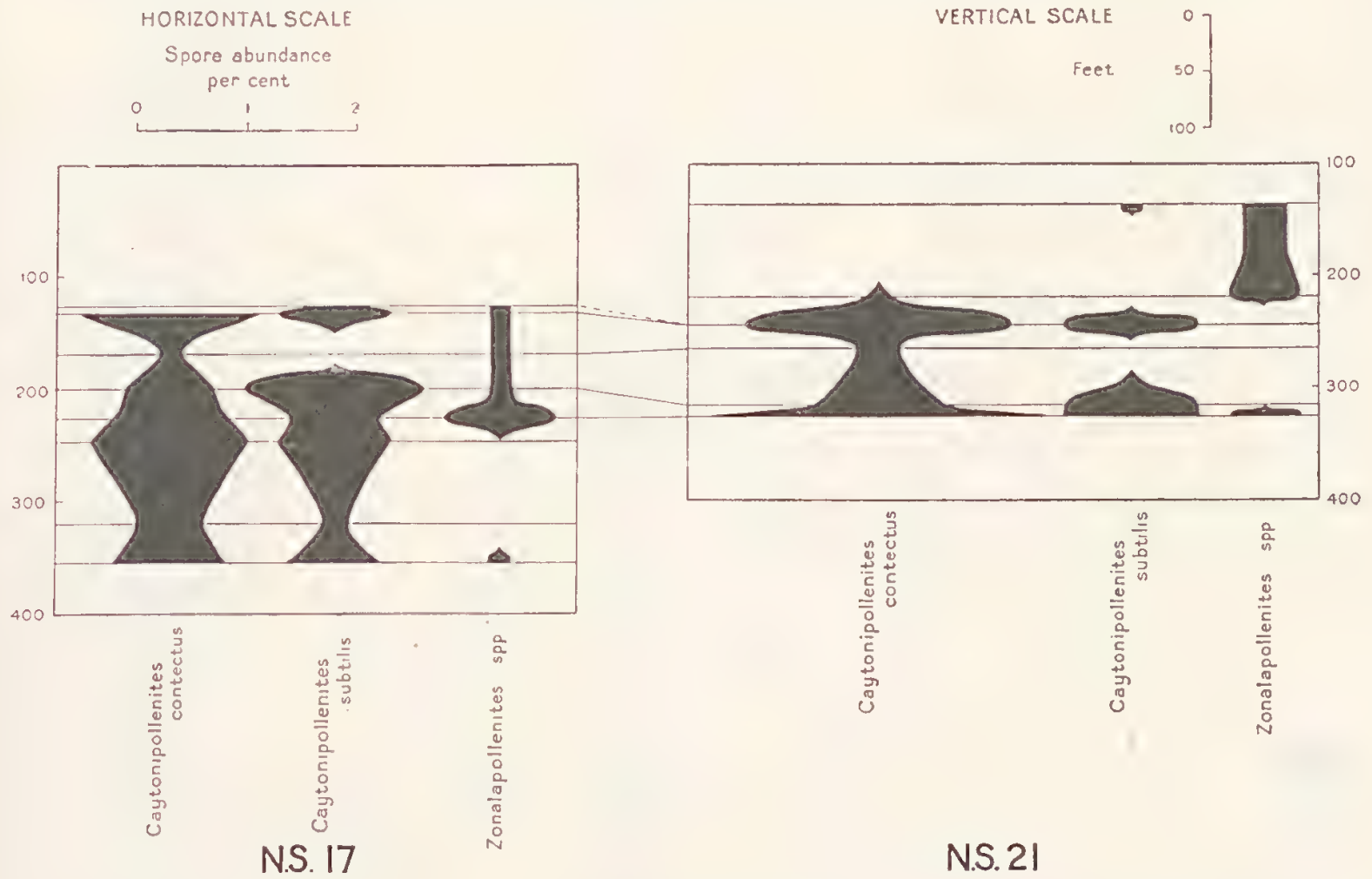
(iii) Unnamed (Bottom) Seam

This seam, which represents the lowest persistent coal horizon in the Walloon Coal Measures, lies approximately 100 ft. above the junction between that formation and the underlying Marburg Sandstone. Although variable in thickness and section, it is usually identifiable in bores intersecting the lower portion of the coal measures. A representative section of this seam is furnished by the succession of coal and shale bands from 637 ft. 10 in. to 645 ft. 8¾ in. in Bore N.S. 42. The percentage distribution of spore and pollen species in this section is included in Table 1.

The spore assemblage resembles that of the other seams in the lower portion of the coal measures in having a significant proportion of *Caytonipollenites*, the proportion of *C. contectus* in the section in N.S. 42 being 1·0 per cent. Of the other Key species, *Sphagnumsporites clavus* and *Cingulatisporites granulatus* are absent, and the two species of

Figure 3

Distribution of Key Species as applied to Seam Correlation
Bores N.S.17 and N S 21 (Lanefield No.5 and Rosemount No4 Mine Areas)



To accompany report by N J de Jersey, M Sc., Ph.D., D.I.C., Research Geologist.

Zonalapollenites are relatively rare. A species which is of possible correlative value in the recognition of this seam is *Leiotriletes crassus,* which has a proportion of 0·8 per cent., a percentage significantly higher than the other seams in the succession. However, this requires confirmation by examination of several samples of the seam from various areas of the coalfield.

The banded section in Bore N.S. 17, in the Lanefield No. 5 Mine area, including the coal seam from 356 ft. 1½ in. to 358 ft. 6 in., is correlated with the Unnamed (Bottom) seam, both on the basis of its spore assemblage and its stratigraphical position. As in the section in Bore N.S. 42, *Caytonipollenites contectus* has a proportion of 1·0 per cent., *Sphagnumsporites clavus* and *Cingulatisporites granulatus* are absent, and the two species of *Zonalapollenites* are relatively rare. The proportion of *Leiotriletes crassus* is 0·4 per cent., this species being absent in all the higher seams examined in Bore N.S. 17.

The only other section examined which may possibly be correlated with this seam is that from 504 ft. 2 in. to 506 ft. 1 in. in N.S. 11, in the Malabar mine area. This consists of two thin coal bands separated by shale. The assemblage resembles that of the sections described above, except that it lacks *Leiotriletes crassus.* The absence of this species may be related to the thinness of the coal bands (3 in. and 3½ in. respectively), as the time required for development of a fully representative flora may have been lacking.

(iv) "Westvale No. 5" Seam

This seam is from about 60 to 100 ft. above the Unnamed (Bottom) seam. It attains its best development in the south-western portion of the field and, as far as is known, is below workable thickness in other areas. In recent years it has been worked in Westvale No. 5 colliery, and it was also worked in the abandoned Lanefield Nos. 1–4 collieries to the south-west (see Map—Figure 1). The correlation of the sections in Lanefield No. 4 and Westvale No. 5 collieries has been established on the basis of spore distribution (de Jersey 1955b, p. 820) and the seam has also been recognised in Bore N.S. 17, in the Lanefield No. 5 mine area, to the east, between the depths of 247 ft. 6 in. and 249 ft. 6 in. The latter section

FIGURE 4

CORRELATION BASED ON SPORE DISTRIBUTION

BORES N.S. 17 and N.S. 21

Open hole sections omitted

Rosewood Coalfield

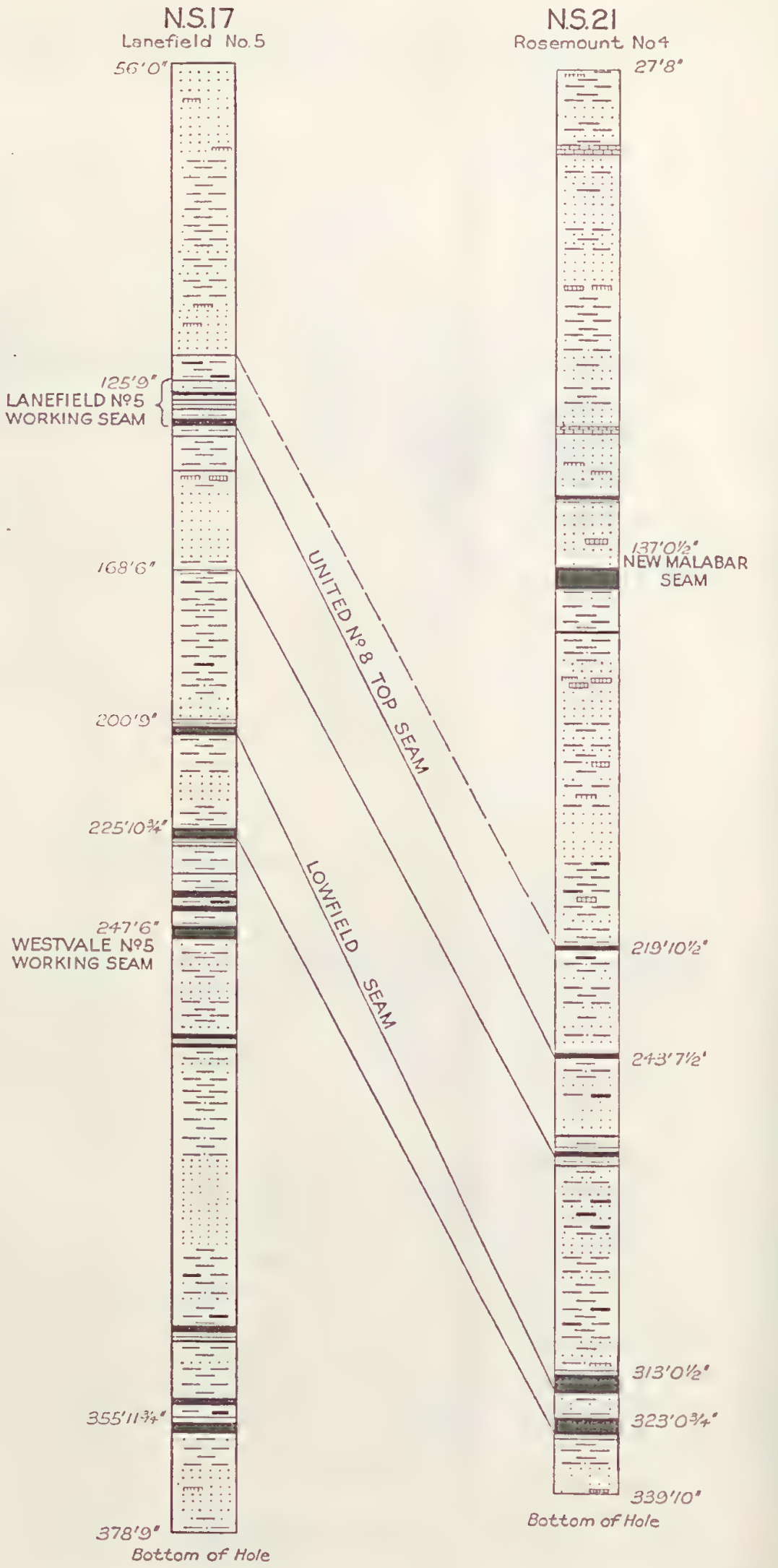
SCALE OF FEET

20 0 20 40 60

LEGEND

- Coal
- Interbanded Coal and Shale
- Shale
- Shale with thin Coal bands
- Siltstone
- Sandstone
- Iron Carbonate
- Calcium Carbonate

To Accompany Report by N.J. de Jersey, M.Sc., Ph.D., D.I.C. Research Geologist.



(in Bore N.S. 17) furnishes a typical spore assemblage, the percentage composition of which is given below in Table 3:—

TABLE 3

PERCENTAGE DISTRIBUTION OF SPECIES IN SAMPLE FROM BORE N.S. 17 247 FT. 6 IN. TO 249 FT. 6 IN.

Species	Percentage
Sphagnumsporites australis	0·2
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	A
Sphagnumsporites adnatus	1·2
Lycopodium rosewoodensis	2·6
Lycopodium triangularis	0·8
Osmundacidites cf. *wellmanii*	A
Gleichenia cf. *circinidites*	0·2
Cyathidites parvus	1·4
Leptolepidites verrucatus	0·2
Leiotriletes directus	22·2
Leiotriletes magnus	1·0
Leiotriletes mortoni	0·2
Leiotriletes crassus	A
Granulatisporites minor	0·2
Cyclogranisporites breviradiata	0·2
Punctatisporites crassiradiata	A
Punctatisporites minimus	A
Verrucosisporites walloonensis	2·2
Verrucosisporites triangularis	0·4
Acanthotriletes pallidus	A
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	1·2
Annulispora densata	0·2
Pilasporites minutus	4·2
Pilasporites crassus	A
Marsupipollenites psilatus	A
Entylissa nitidus	5·6
Entylissa crassimarginis	0·6
Entylissa magna	0·2
Caytonipollenites contectus	1·4
Caytonipollenites subtilis	1·0
Araucariacites cf. *australis*	19·8
Inaperturopollenites reidi	
Inaperturopollenites sp.	1·8
Zonalapollenites dampieri	A
Zonalapollenites segmentatus	A
Pityosporites parvisaccatus	A
Pityosporites psilatus	A
Others	31·0

This assemblage contains significant proportions of *Caytonipollenites contectus* and *C. subtilis*, the proportions being 1·4 per cent. and 1·0 per cent. respectively. The remaining Key species— *Sphagnumsporites clavus, Leiotriletes crassus, Cingulatisporites granulatus, Zonalapollenites dampieri*, and *Z. segmentatus* are all absent. The absence of *L. crassus* suggests a means of distinguishing the seam from the Unnamed (Bottom) seam below. Distinction from the seams above the Lowfield seam and the Unnamed seam between the Lowfield and "Westvale No. 5" seams—is more difficult as these seams show a general resemblance to the "Westvale No. 5" seam in their proportions of *Caytonipollenites*. Features of possible value in distinguishing the assemblage from these upper seams are (1) the absence of *Zonalapollenites* and (2) the absence of *Sphagnumsporites clavus*. In the next seam above (from 226 ft. 11 in. to 228 ft. 1 in. in Bore N.S. 17) the proportion of *Zonalapollenites* is 1·0 per cent. (This is the Unnamed seam between the "Westvale No. 5" and Lowfield seams). In the Lowfield seam *Zonalapollenites* is again rare or absent. The distribution of this genus may thus find application in distinguishing the Unnamed seam from the "Westvale No. 5" seam. On the other hand, *Sphagnumsporites clavus,* which is absent in the latter seam, is normally present in significant proportions in the Lowfield seam, and thus affords a means of distinguishing the "Westvale No. 5" and Lowfield seams.

The percentage distribution of *Caytonipollenites contectus, C. subtilis* and *Zonalapollenites* is shown diagrammatically in Figure 3, which illustrates the correlation of Bore N.S. 17 and N.S. 21 on the basis of spore distribution. In Figure 4 this correlation is illustrated by comparison of generalised logs of the two bores.

The "Westvale No. 5" seam has not been investigated with regard to spore distribution in areas away from the south-western portion of the Coalfield, as in such areas it is normally represented by thin coal bands of negligible economic importance. This tendency to impoverishment away from the Westvale No. 5–Lanefield No. 4 area is illustrated by the record of Bore N.S. 42, in which it is probably represented by the coal band between 579 ft. 5½ in. and 580 ft. 8¾ in. The spore population of this coal band exhibits a general similarity to the assemblage described above.

(v) UNNAMED SEAM (between the "Westvale No. 5" and Lowfield seams)

In Bore N.S. 17 this seam is approximately 20 ft. above the "Westvale No. 5" seam. The distance to the Lowfield seam above is rather variable, decreasing from about 21 ft. in Bore N.S. 17 to less than 6 ft. in N.S. 21. The seam is well developed in Bore N.S. 21, being represented by the section from 322 ft. 0¾ in. to 326 ft. 9¾ in., and the spore assemblage of this coal section, which is characteristic of the seam, is given below in Table 4:—

TABLE 4

PERCENTAGE DISTRIBUTION OF SPECIES IN SAMPLE FROM BORE N.S. 21 322 FT. 0¾ IN. TO 326 FT. 9¾ IN.

Species	Percentage
Sphagnumsporites australis	0·2
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	0·4
Sphagnumsporites adnatus	0·6
Lycopodium rosewoodensis	3·4
Lycopodium triangularis	0·4
Osmundacidites cf. *wellmanii*	0·8
Gleichenia cf. *circinidites*	0·4
Cyathidites parvus	1·0
Leptolepidites verrucatus	1·2
Leiotriletes directus	15·6
Leiotriletes magnus	0·8
Leiotriletes mortoni	0·2
Leiotriletes crassus	A
Granulatisporites minor	0·2
Cyclogranisporites breviradiata	1·6
Punctatisporites crassiradiata	A
Punctatisporites minimus	0·2
Verrucosisporites walloonensis	0·8
Verrucosisporites triangularis	A
Acanthotriletes pallidus	0·4
Rugulatisporites ramosus	0·2
Cingulatisporites granulatus	A
Annulispora folliculosa	1·0
Annulispora densata	0·2
Pilasporites minutus	2·6
Pilasporites crassus	0·2

TABLE 4—*continued*

PERCENTAGE DISTRIBUTION OF SPECIES IN SAMPLE FROM BORE N.S. 21 322 FT. 0¾ IN. TO 326 FT. 9¾ IN.—*continued*

Species	Percentage
Marsupipollenites psilatus	A
Entylissa nitidus	6·4
Entylissa crassimarginis	0·6
Entylissa magna	0·2
Caytonipollenites contectus	3·0
Caytonipollenites subtilis	1·2
Araucariacites cf. *australis*	25·6
Inaperturopollenites reidi	
Inaperturopollenites sp.	1·6
Zonalapollenites dampieri	0·6
Zonalapollenites segmentatus	0·4
Pityosporites parvisaccatus	A
Pityosporites psilatus	A
Others	28·0

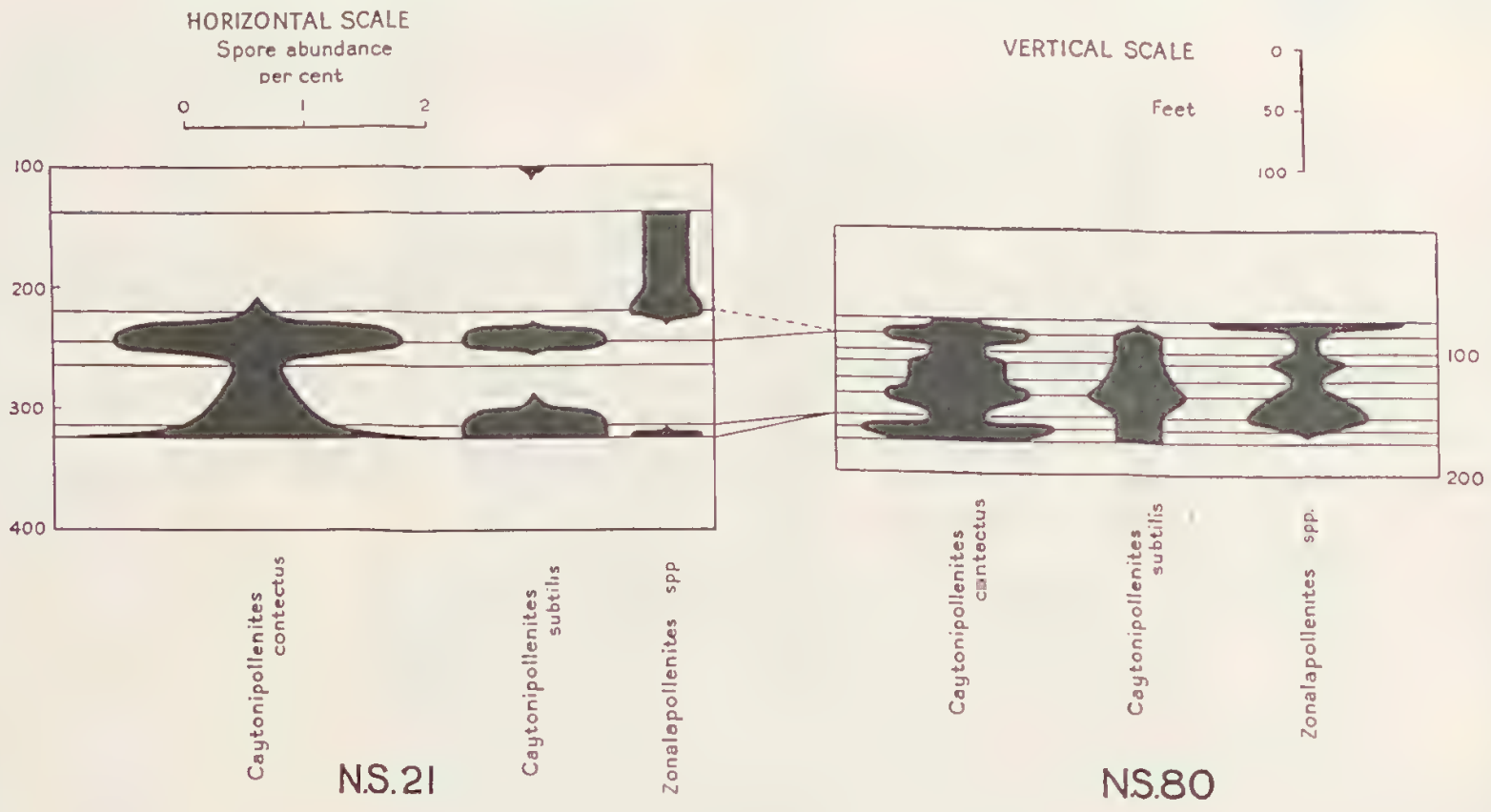
This spore assemblage contains significantly high percentages of *Caytonipollenites contectus* and *C. subtilis,* the proportion of the former species (3·0 per cent.) in this sample being the highest recorded for *C. contectus* in any sample from the coalfield. Of the other Key species, *Sphagnumsporites clavus, Leiotriletes crassus,* and *Cingulatisporites granulatus* are absent, as in the "Westvale No. 5" seam below. The assemblage contains a significant proportion (1·0 per cent.) of the genus *Zonalapollenites,* and in this respect differs from that of the "Westvale No. 5" seam, in which this genus is rare or absent.

The presence of a similar proportion of this genus (1·0 per cent.) in a sample from N.S. 17 (226 ft. 11 in. to 228 ft. 1 in.) suggests the correlation of this section with the seam in N.S. 21, and this correlation is shown diagrammatically in Figures 3 and 4. To the north of N.S. 21 spore distribution studies suggest that the seam is present in Bore N.S. 80 in the United No. 8 mine area. In the latter bore the section between 154 ft. 8¼ in. and 162 ft. 2½ in. contains 1·0 per cent. of *Zonalapollenites.* This suggests that this Unnamed seam is represented in portion of this thick banded section; this portion is probably in the lower part of the section, as according to J. B. Cameron (verbal communication) the upper portion of the section from 154 ft. 8¼ in. to 162 ft. 2½ in. can be correlated with the Lowfield seam on stratigraphic and lithological evidence. These correlations (between N.S. 21 and N.S. 80) are illustrated in Figures 5 and 6.

In Bore N.S. 42 none of the coal sections studied between the Lowfield seam and the Unnamed (Bottom) seam contain significant proportions of *Zonalapollenites,* and this suggests either that the seam is not represented in that bore or that the characteristically high proportion of the genus is restricted to portion of the seam section which has partially, or completely, lensed out before reaching N.S. 42. A similar position exists with regard to Bore N.S. 11, in which, likewise, no peak in the distribution of *Zonalapollenites,* indicative of this seam, could be found in the coal sections in the lower part of the bore. The above distribution of bore and colliery sections indicates that the seam is best known from the western portion of the coalfield, in the Rosemount No. 4 and United No. 8 mine areas. It is not known as a workable seam in other areas of the field.

Figure 5

Distribution of Key Species as applied to Seam Correlation
Bores N.S.21 and N.S.80 (Rosemount No.4 and United No.8 Mine Areas)



To accompany report by N.J de Jersey, M.Sc., Ph.D., D.I.C., Research Geologist.

FIGURE 6

SHOWING CORRELATION OF SEAMS

BORES N.S. 21 (Lower portion) and N.S. 80

Rosewood Coalfield

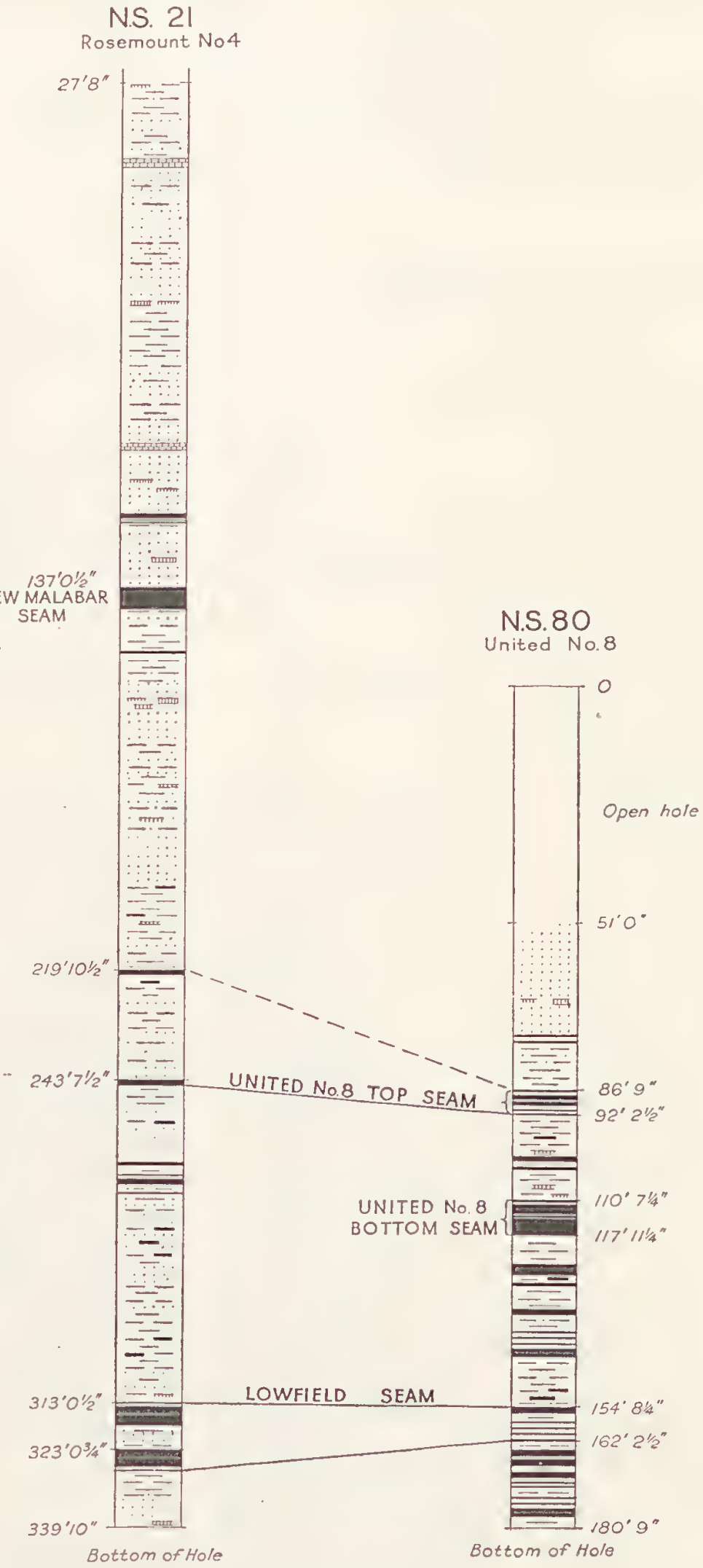
SCALE OF FEET

20 0 20 40 60

LEGEND

- Coal
- Interbanded Coal and Shale
- Shale
- Shale with thin Coal bands
- Siltstone
- Sandstone
- Iron Carbonate
- Calcium Carbonate

To Accompany Report by N.J. de Jersey, M Sc, Ph D, D I C, Research Geologist



(vi) Lowfield Seam

This name was proposed by the writer (de Jersey 1955b, p. 620) for the seam first worked in Lowfield No. 1 colliery. In bores drilled in the Lanefield No. 5 mine area, to the south-east of this colliery, it is about 40 to 60 ft. above the "Westvale No. 5" seam. The spore assemblage, typical of the seam, is given below in Table 5 for the section from 200 ft. 9 in. to 205 ft. 4¾ in. in Bore N.S. 17:—

TABLE 5

Percentage Distribution of Species in Sample from Bore N.S. 17, 200 ft. 9 in. to 205 ft. 4¾ in.

Species	Percentage
Sphagnumsporites australis	0·6
Sphagnumsporites clavus	0·2
Sphagnumsporites tenuis	0·6
Sphagnumsporites adnatus	0·8
Lycopodium rosewoodensis	5·8
Lycopodium triangularis	1·4
Osmundacidites cf. *wellmanii*	0·2
Gleichenia cf. *circinidites*	0·2
Cyathidites parvus	0·8
Leptolepidites verrucatus	0·8
Leiotriletes directus	14·4
Leiotriletes magnus	1·0
Leiotriletes mortoni	A
Leiotriletes crassus	A
Granulatisporites minor	0·2
Cyclogranisporites breviradiata	0·2
Punctatisporites crassiradiata	A
Punctatisporites minimus	0·2
Verrucosisporites walloonensis	0·8
Verrucosisporites triangularis	0·6
Acanthotriletes pallidus	0·6
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	1·2
Annulispora densata	0·2
Pilasporites minutus	6·4
Pilasporites crassus	A
Marsupipollenites psilatus	A
Entylissa nitidus	10·4
Entylissa crassimarginis	1·0
Entylissa magna	0·8
Caytonipollenites contectus	0·8
Caytonipollenites subtilis	1·6
Araucariacites cf. *australis*	23·6
Inaperturopollenites reidi	
Inaperturopollenites sp.	2·2
Zonalapollenites dampieri	A
Zonalapollenites segmentatus	0·2
Pityosporites parvisaccatus	A
Pityosporites psilatus	A
Others	22·2

The Lowfield seam contains significant proportions of both *Caytonipollenites contectus* and *C. subtilis*. *Zonalapollenites* is rare or absent, in contrast to the Unnamed seam immediately below. A characteristic species is *Sphagnumsporites clavus;* this species is present in significant proportions and normally reaches its acme of abundance at, or near, the horizon of the Lanefield seam. *Leiotriletes crassus* is absent, in contrast to the Unnamed (Bottom) seam.

On the basis of the distribution of *Caytonipollenites, Zonalapollenites* and *Sphagnumsporites clavus,* the section in N.S. 17 (from 200 ft. 9 in. to 205 ft. 4¾ in.) is correlated with the section from 313 ft. 0½ in. to 317 ft. 4½ in. in N.S. 21. This correlation is illustrated by diagrams in Figures 3 and 4.

In Bore N.S. 42, in the Oakleigh mine area, recognition of the Lowfield seam is more difficult on the basis of spore distribution as the Unnamed seam below it cannot be recognised in the absence of a characteristic maximum in the distribution of *Zonalapollenites.* The proportions of the species of *Caytonipollenites* are of no help as all the seams in this part of the succession show significant, if somewhat variable, percentages of these two species. *Sphagnumsporites clavus,* which is a characteristic member of the Lowfield seam assemblage, is present in three sections in the relevant portion of the succession in this bore. These are the sections at 465 ft. 9½ in., 512 ft. 9½ in., and 515 ft. 7¼ in. This distribution suggests that the Lowfield seam must be in this part of the succession and this is in accord with the general position of the Lowfield seam in the stratigraphic column. Fortunately in this uncertainty of correlation additional evidence is supplied by lithology. J. B. Cameron (verbal communication) has found that one of the stone bands in the seam has a characteristic bentonitic composition which is persistent laterally and indicates that the Lowfield seam is represented in N.S. 42 by the section encountered at 512 ft. 9½ in.

In the United No. 8 mine area, Bore N.S. 80 has been selected for detailed study of spore distribution. According to J. B. Cameron (verbal communication) stratigraphic and lithological evidence indicates that the Lowfield seam is represented by the upper part of the section from 154 ft. 8¼ in. to 162 ft. 2½ in. in this bore. This correlation is supported by evidence based on spore distribution, as *Sphagnumsporites clavus* is present in this section. In addition the presence of 1·0 per cent. of *Zonalapollenites* indicates, as described in the previous section, that this thick banded section includes both the Lowfield seam and the Unnamed seam between it and the "Westvale No. 5" seam. The correlation between Bores N.S. 21 and N.S. 80 is shown diagrammatically in Figures 5 and 6.

In Bore N.S. 3, in the Roughrigg mine area, the section showing the closest similarity in its spore assemblage to the Lowfield seam is that from 512 ft. 4 in. to 513 ft. 11 in. A similar spore assemblage is present in the section from 361 ft. 8 in. to 363 ft. 6 in. in Bore N.S. 11 in the Malabar mine area. However, the correlation of both these sections is subject to confirmation by lithological evidence as indicated above.

(vii) "United No. 8 Bottom" Seam

A typical spore assemblage of this seam which is the Bottom seam of United No. 8 colliery is given by the section from 110 ft. 7¼ in. to 117 ft. 11½ in. in Bore N.S. 80, which was drilled adjacent to the

workings of that colliery. The percentage distribution of species in this assemblage is given below in Table 6:—

TABLE 6

PERCENTAGE DISTRIBUTION OF SPECIES IN SAMPLE FROM BORE N.S. 80, 110 FT. 7¼ IN. TO 117 FT. 11½ IN.

Species	Percentage
Sphagnumsporites australis	0·8
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	1·4
Sphagnumsporites adnatus	1·4
Lycopodium rosewoodensis	11·6
Lycopodium triangularis	0·6
Osmundacidites cf. *wellmanii*	A
Gleichenia cf. *circinidites*	A
Cyathidites parvus	0·2
Leptolepidites verrucatus	1·2
Leiotriletes directus	10·6
Leiotriletes magnus	0·4
Leiotriletes mortoni	0·4
Leiotriletes crassus	A
Granulatisporites minor	1·2
Cyclogranisporites breviradiata	A
Punctatisporites crassiradiata	A
Punctatisporites minimus	0·4
Verrucosisporites walloonensis	1·0
Verrucosisporites triangularis	0·2
Acanthotriletes pallidus	0·4
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	1·0
Annulispora densata	0·2
Pilasporites minutus	5·0
Pilasporites crassus	1·2
Marsupipollenites psilatus	0·2
Entylissa nitidus	4·2
Entylissa crassimarginis	A
Entylissa magna	A
Caytonipollenites contectus	0·8
Caytonipollenites subtilis	0·4
Araucariacites cf. *australis*	38·0
Inaperturopollenites reidi	
Inaperturopollenites sp.	4·6
Zonalapollenites dampieri	0·2
Zonalapollenites segmentatus	0·4
Pityosporites parvisaccatus	1·0
Pityosporites psilatus	0·2
Others	10·8

In Bore N.S. 80, in the United No. 8 mine area, this seam is approximately 36 ft. above the Lowfield seam. Like the latter seam, its spore assemblage contains significant proportions of *Caytonipollenites contectus* and *C. subtilis*. The proportion of *Zonalapollenites*—0·6 per cent.—is intermediate between those of the Lowfield seam and the Unnamed seam between the Lowfield and "Westvale No. 5" seams. *Leiotriletes crassus* and *Cingulatisporites granulatus* are both absent. The absence of *Sphagnumsporites clavus*, if a persistent feature, would provide a means of distinguishing the seam from the Lowfield seam below. The assemblage differs from that of the "United No. 8 Top" seam above in having a somewhat higher proportion of *Zonalapollenites* and also in having an appreciably lower proportion of *Caytonipollenites* than is present in the lower section of that seam.

The "United No. 8 Bottom" seam appears to be one of the less persistent seams and has not been identified beyond the United No. 8 mine area on the basis of spore distribution. It evidently deteriorates to the south as in the appropriate position (between the Lowfield and "United No. 8 Top" seams) in Bores N.S. 17 and N.S. 21 there are only thin coal bands, one foot or less in thickness. To the east, in N.S. 42, there are three sections in this part of the succession which could possibly represent the "United No. 8 Bottom" seam. These are the sections at 455 ft. 10 in., 465 ft. 9½ in. and 484 ft. 1 in. Which of these sections represents the seam cannot be determined on the basis of spore distribution as their spore assemblages are fairly similar, without any striking differences which could enable identification of the seam. For similar reasons this seam cannot be definitely identified in Bores N.S. 3 and N.S. 11 to the north-east in the Roughrigg and Malabar mine areas, respectively and in N.S. 17, in the Lanefield No. 5 mine area. More recent work indicates that the correlation with the "Lanefield No. 5" seam (de Jersey 1957b, p. 156) in N.S. 17 cannot be substantiated and that the seam probably lies between the "Lanefield No. 5" and Lowfield seams in that bore.

(viii) "United No. 8 Top" Seam

In Bore N.S. 80 this seam which is the Top seam of United No. 8 Colliery is about 20 ft. above the "United No. 8 Bottom" seam. The following spore assemblage (in Table 7) is that of the section from 86 ft. 9 in. to 92 ft. 2½ in. in Bore N.S. 80:—

TABLE 7

PERCENTAGE DISTRIBUTION OF SPECIES IN SAMPLE FROM BORE N.S. 80, 86 FT. 9 IN. TO 92 FT. 2½ IN.

Species	Percentage
Sphagnumsporites australis	1·0
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	1·0
Sphagnumsporites adnatus	0·4
Lycopodium rosewoodensis	8·4
Lycopodium triangularis	0·6
Osmundacidites cf. *wellmanii*	0·4
Gleichenia cf. *circinidites*	0·4
Cyathidites parvus	A
Leptolepidites verrucatus	0·4
Leiotriletes directus	15·8
Leiotriletes magnus	1·2
Leiotriletes mortoni	A
Leiotriletes crassus	0·4
Granulatisporites minor	0·2
Cyclogranisporites breviradiata	A
Punctatisporites crassiradiata	0·4
Punctatisporites minimus	0·4
Verrucosisporites walloonensis	2·2
Verrucosisporites triangularis	0·4
Acanthotriletes pallidus	0·4
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	2·6
Annulispora densata	0·6
Pilasporites minutus	3·2
Pilasporites crassus	A
Marsupipollenites psilatus	A
Entylissa nitidus	5·0
Entylissa crassimarginis	0·4
Entylissa magna	0·2
Caytonipollenites contectus	1·2
Caytonipollenites subtilis	0·4
Araucariacites cf. *australis*	4·2
Inaperturopollenites reidi	23·0
Inaperturopollenites sp.	9·6
Zonalapollenites dampieri	0·2
Zonalapollenites segmentatus	A
Pityosporites parvisaccatus	0·4
Pityosporites psilatus	0·2
Others	14·8

This spore assemblage is characterised by the presence of *Caytonipollenites* in significant proportion, the total proportion of the genus being 1·6 per cent. This feature is shared by the majority of seams lower in the succession, but affords a sharp contrast to seams higher in the sequence, as in the higher seams the proportion of the genus is very rarely greater than 0·2 per cent. The seam can thus be recognised in a vertical sequence of spore assemblages by being the highest seam in which *Caytonipollenites* is present in significant proportions. With regard to the other Key species, *Sphagnumsporites clavus* is absent, *Leiotriletes crassus* is present in minor amounts, and *Cingulatisporites granulatus* is absent. The two species of *Zonalapollenites* are relatively rare or absent.

In most bore or colliery sections the seam is split into two portions. In Bore N.S. 80 these were combined for study of spore distribution. In Bore N.S. 42 in the Oakleigh mine area, the seam has been recognised on the basis both of its stratigraphic position and the spore assemblage described above. In this bore the seam is characteristically split into two sections which were studied separately with regard to spore distribution. These are the sections from 406 ft. 0¾ in. to 408 ft. 11 in. and from 411 ft. 9¼ in. to 413 ft. 2¾ in. The spore assemblages of these sections in N.S. 42 have been recorded above in Table 1. Study of these assemblages indicates that the significantly high proportions of *Caytonipollenites* are confined to the lower section, the genus being rare or absent in the upper section. The percentages of the two species are given below in Table 8:—

TABLE 8

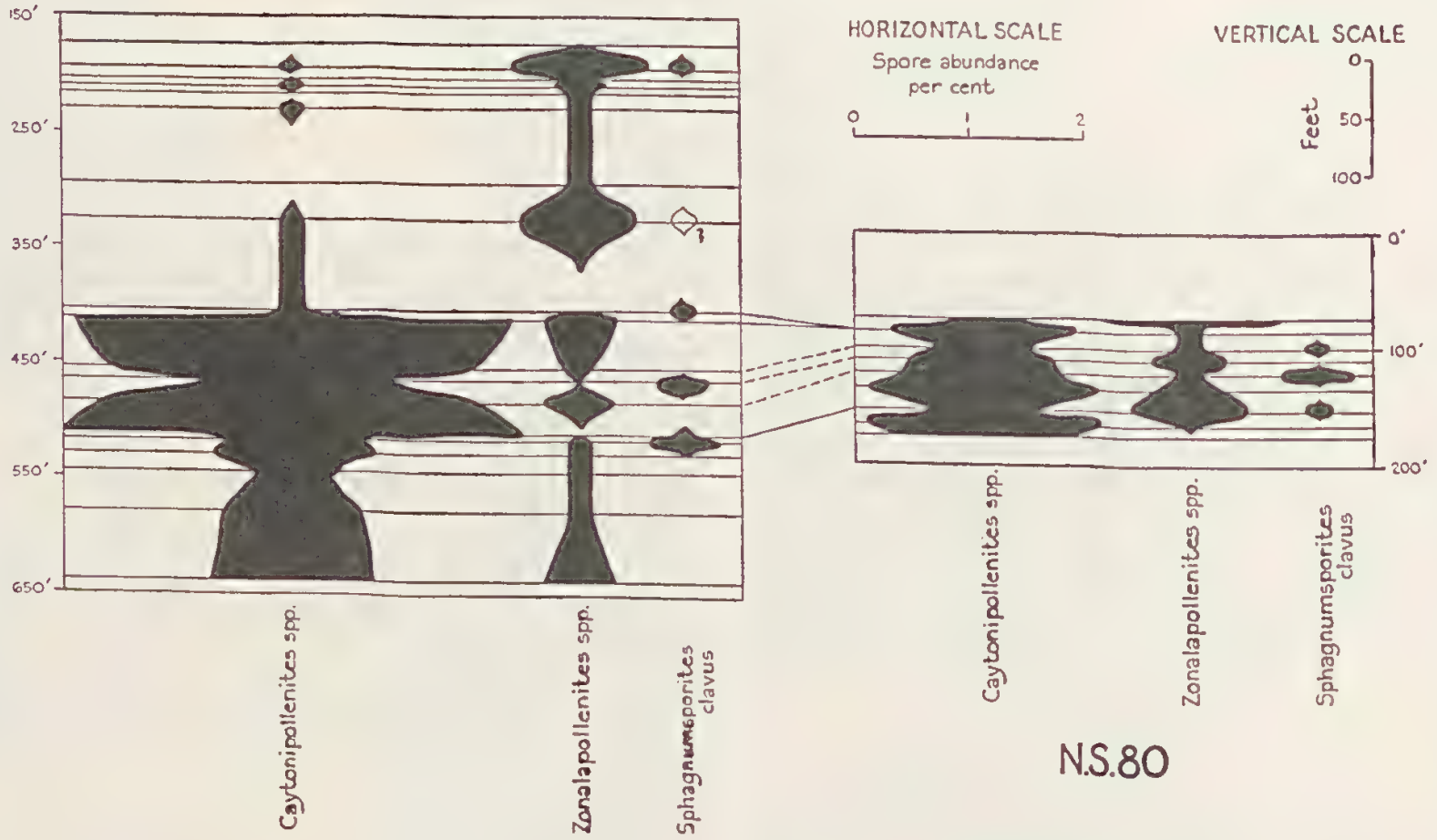
PERCENTAGE OF *Caytonipollenites* IN LOWER AND UPPER SECTIONS OF "UNITED NO. 8 TOP" SEAM IN N.S. 42

Section Sampled	Species	
	C. contectus	*C. subtilis*
406 ft. 0¾ in. to 408 ft. 11 in. ..	0·2	A
411 ft. 9¼ in. to 413 ft. 2¾ in ..	2·4	1·4

This sharp distinction in the spore assemblages between upper and lower sections should provide an additional criterion for recognising it in other areas on the basis of spore content.

Correlation of the seam between Bores N.S. 80 and N.S. 42 is shown diagrammatically in Figures 7 and 8. To the south, in Bore N.S. 21, in the Rosemount No. 4 mine area, the highest section with an appreciable proportion of *Caytonipollenites* is that from 243 ft. 7½ in. to 244 ft. 1½ in. and this has accordingly been correlated with the lower section of the "United No. 8 Top" seam. Another coal section

Figure 7
Distribution of Key Species as applied to Seam Correlation
Bores N.S.42 and N.S.80 (Oakleigh and United No 8 Mine Areas)



To accompany report by
N.J. de Jersey, M.Sc., Ph.D., D.I.C., Research Geologist.

T.M.L.

FIGURE 8

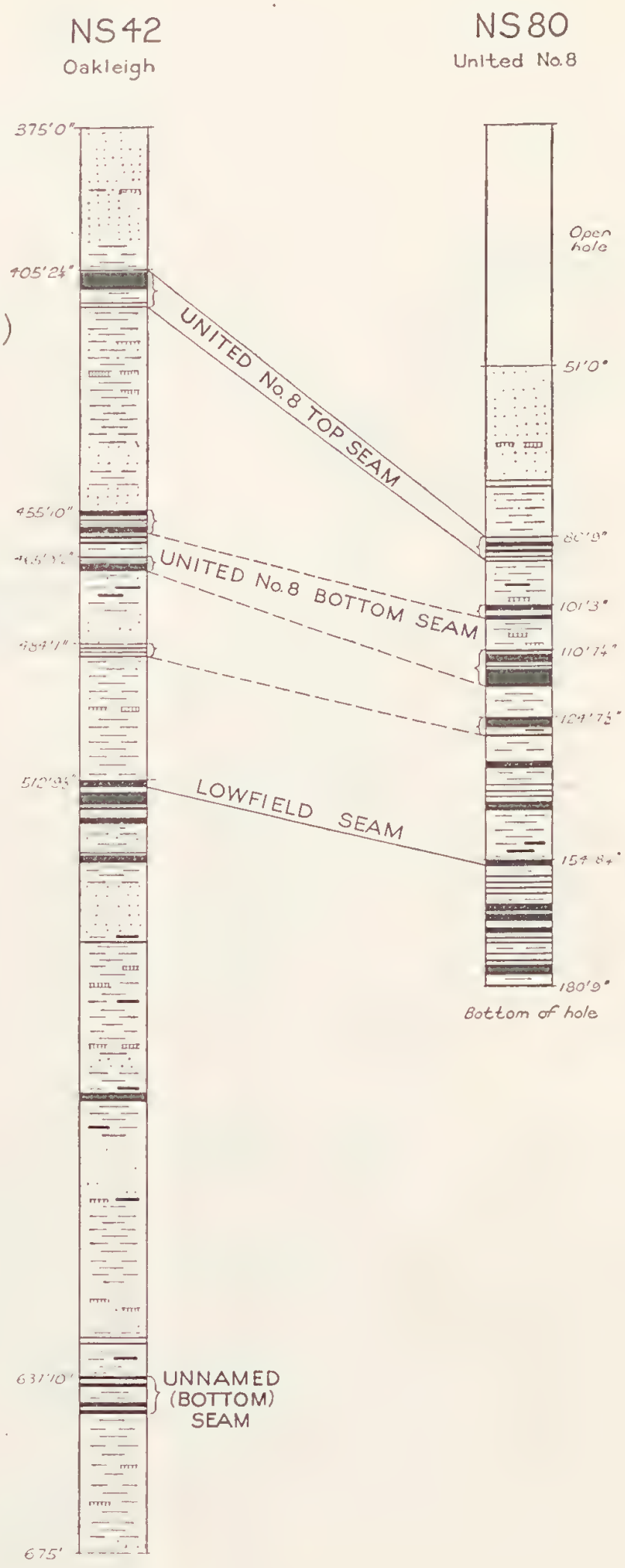
CORRELATION OF SEAMS.

BORES N.S. 42 (Middle Portion) AND N.S 80 Rosewood Coalfield

LEGEND

- Coal
- Interbanded Coal and Shale
- Shale
- Shale with thin Coal bands
- Siltstone
- Sandstone
- Iron Carbonate
- Calcium Carbonate

To Accompany Report by N.J deJersey, M Sc., Ph D., D.I.C, Research Geologist.



about 20 feet above this in the bore (from 220 ft. 4½ in. to 221 ft. 4¾ in.), in which *Caytonipollenites* is relatively rare, may represent the upper section of the seam. If this is so, the sediments separating the two sections of the seam have thickened considerably going south from N.S. 42 to N.S. 21. The correlation between Bores N.S. 21 and N.S. 80 is illustrated in Figures 5 and 6.

Further west, in Bore N.S. 17, in the Lanefield No. 5 mine area, the highest seam with appreciable proportions of *Caytonipollenites* is the Lanefield No. 5 working seam, sampled betwen the depths of 128 ft. 8 in. and 135 ft. 10 in. According to J. B. Cameron (verbal communication) stratigraphic evidence indicates that this section is equivalent to the "United No. 8 Top" seam. This correlation is thus supported by evidence based on spore distribution. The correlation between bores N.S. 17 and N.S. 21 is shown diagrammatically in Figures 3 and 4. Examination of the correlation diagrams indicates that the seam can be traced through from N.S. 80 to N.S. 42, to N.S. 21 and then to N.S. 17.

One problem of spore distribution which has yet to be solved is the identification of the top section of the seam in Bore N.S. 17. In both sections of the Lanefield No. 5 working seam examined in this bore *Caytonipollenites* was present in significant proportions, suggesting either that the top section has lensed out and is not represented or that it was combined with portion of the lower section of the seam in the upper section examined in the bore (from 128 ft. 8 in. to 132 ft. 1 in.). Further data on the problem would be supplied by an investigation of the spore distribution band by band through the seam section in the various bores between N.S. 42 and N.S. 17. Such an investigation would establish the position in each bore section in which the proportion of *Caytonipollenites* shows an abrupt diminution and thus enable this horizon to be traced through the area from one bore to the next.

In the northern part of the coalfield, the seam can be recognised in bores drilled in the Roughrigg and Malabar mine areas. This recognition is based both on spore distribution and on the fairly uniform interval separating it from the New Malabar seam above. The two bores studied in this part of the field were N.S. 3 and N.S. 11, respectively, in the Roughrigg and Malabar mine areas. These two bores were not studied in the same detail as N.S. 42, so that the correlation of the lower section of the seam is not definitely established. In particular the evidence now available on spore distribution, particularly the detailed study of the succession made in N.S. 42, indicates that the correlation suggested of the section at 243 ft. 7½ in. in N.S. 21 with the section at 466 ft. 4½ in. in N.S. 3 (de Jersey 1955b, p. 619) is incorrect. The section from 398 ft. 3½ in. to 400 ft. 11½ in. in N.S. 3 has a spore assemblage similar to that of the top section of the "United No. 8 Top" seam. More detailed work on further coal sections from this bore would be necessary to indicate the position of the bottom section of this seam.

In Bore N.S. 69, in the Moorefield No. 3 mine area, a seam split into two sections was intersected between the depths of 146 ft. 1 in. and 148 ft. 9 in. and between 139 ft. 8½ in. and 142 ft. 2 in. The presence of *Caytonipollenites* in significant proportions in these sections (in proportions of 1·6 and 1·2 per cent. respectively), together with the absence of any major seams for considerable interval in the overlying strata, suggest that both these sections are equivalent to the lower section of the "United No. 8 Top" seam. The absence of a section with *Caytonipollenites* rare or absent, as is characteristic of the top section of this seam, indicates that this portion of the seam has either lensed out in the distance of approximately 5 miles from Bore N.S. 42, or has been removed by contemporaneous erosion.

(ix) New Malabar Seam

This seam was named by W. L. Hawthorne (1954a, p. 6) who has described its distribution in the Malabar mine area. It is generally of the order 80 to 90 ft. above the "United No. 8 Top" seam. The percentage distribution of the species in a typical section of the seam is given below for the section in New Malabar colliery (1954 tunnel) (Table 9).

TABLE 9

Percentage Distribution of Species in Sample from New Malabar Colliery (1954 tunnel)

Species	Percentage
Sphagnumsporites australis	0·8
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	1·0
Sphagnumsporites adnatus	0·8
Lycopodium rosewoodensis	4·8
Lycopodium triangularis	1·4
Osmundacidites cf. *wellmanii*	0·4
Gleichenia cf. *circinidites*	2·0
Cyathidites parvus	0·4
Leptolepidites verrucatus	2·8
Leiotriletes directus	15·0
Leiotriletes magnus	1·2
Leiotriletes mortoni	A
Leiotriletes crassus	A
Granulatisporites minor	0·2
Cyclogranisporites breviradiata	0·4
Punctatisporites crassiradiata	A
Punctatisporites minimus	0·2
Verrucosisporites walloonensis	1·8
Verrucosisporites triangularis	0·8
Acanthotriletes pallidus	0·2
Rugulatisporites ramosus	0·2
Cingulatisporites granulatus	A
Annulispora folliculosa	2·0
Annulispora densata	0·4
Pilasporites minutus	4·0
Pilasporites crassus	0·2
Marsupipollenites psilatus	A
Entylissa nitidus	7·2
Entylissa crassimarginis	0·6
Entylissa magna	0·4
Caytonipollenites contectus	A
Caytonipollenites subtilis	0·2
Araucariacites cf. *australis*	22·4
Inaperturopollenites reidi	
Inaperturopollenites sp.	5·2
Zonalapollenites dampieri	0·4
Zonalapollenites segmentatus	0·2
Pityosporites parvisaccatus	0·8
Pityosporites psilatus	A
Others	21·6

Characteristic features of the spore assemblage of this seam are the absence of *Sphagnumsporites clavus, Leiotriletes crassus* and *Cingulatisporites granulatus,* the rarity or absence of *Caytonipollenites contectus* and *C. subtilis* and the presence of *Zonalapollenites* in proportions varying from ½ to 1 per cent. The rarity or absence of *Caytonipollenites* and the presence of *Zonalapollenites* are features which provide a ready means of distinction from the "United No. 8 Top" seam below.

The New Malabar seam is one of the most persistent seams in the Rosewood coalfield. In the majority of bore or colliery sections it is characteristically split into two sections; the spore assemblages of the upper and lower sections have been investigated separately and have been found to be essentially similar in the proportions of the Key species. The following sections of the seam have been studied with regard to spore distribution in various parts of the coalfield:—N.S. 3 (Roughrigg mine area) 300 ft. 6 in. to 307 ft. 4 in. (Interbanded coal and shale); Rosemount No. 4 colliery (top seam previously worked); N.S. 42 (Oakleigh mine area), 326 ft. 4 in. to 327 ft. 10 in.; Oakleigh No. 3 colliery (top seam worked); N.S. 48 (Glencoe mine area), 187 ft. 4½ in. to 191 ft. 9 in.; N.S. 40 (Normanton No. 1 mine area), 306 ft. 11½ in. to 310 ft. 5 in.; N.S. 60 (Mt. Elliott mine area), 210 ft. 7½ in. to 212 ft. 9¼ in. and 214 ft. 2½ in. to 215 ft. 6 in. All these sections have essentially similar patterns of distribution of the Key species, illustrating that the spore assemblage remains relatively unchanged when the seam is traced laterally. The correlation between Bores N.S. 42 (Oakleigh mine area), N.S. 48 (Glencoe mine area) and N.S. 40 (Normanton No. 1 mine area) is illustrated diagramatically in Figures 9 and 10. In Figures 11 and 12 is shown the extension of this correlation from N.S. 40 (Normanton No. 1 mine area) to N.S. 60 (Mount Elliott mine area).

(x) Rosewood No. 5 Seam

This name was proposed by the writer (de Jersey 1957a, p. 195) for a previously unnamed seam which is the lowest of the Rosewood group, a group of five seams at the top of the productive section of the coal measures in the Rosewood district. In the Perry's Nob area, where it is best developed, the interval between the Rosewood No. 5 seam and the New Malabar seam below ranges from approximately 70 to 95 feet. The following account will explain the reasons for the selection of this name for the seam and for the selection of a type section:—"This name is here suggested for a previously unnamed seam known in the Glencoe, Oakleigh and Normanton No. 1 mine areas. It is the lowest of the Rosewood group of seams and, as J. H. Reid (1922) has named these seams respectively from the top downwards the Rosewood Nos. 1 to 4 seams, this terminology is carried to completion by naming the bottom seam of the group the Rosewood No. 5 seam. Reid (1922, p. 40) named the two seams immediately above this seam, the Rosewood No. 3 and No. 4 seams on the basis of records of percussion bores in Perry's Nob Colliery. It has been pointed out by J. B. Cameron (verbal communication) that these names are based on reported sections only, and thus do not satisfy the stratigraphic code and, in addition, no samples are available from these bores for study of spore distribution. Consequently it is considered advisable to redefine these three seams on the basis of the section in Glencoe colliery, where they are better developed than at Perry's Nob, (now Oakleigh). Accordingly the Rosewood No. 5 seam is here defined as the lowest seam yet worked in Glencoe colliery, intersected between 116 ft. 0½ in. and 118 ft. 4 in. in Bore N.S. 48. It is known locally as the "Glencoe No. 4" seam (de Jersey 1957a, p. 195).

In Bore N.S. 48 the seam consists of two sections, an upper section of 1 ft. 10½ in. and a lower section 4 in. thick, separated by a thin band of shale. These two sections were combined for study of spore distribution. The spore assemblage of this combined sample is given below in Table 10:—

TABLE 10

Percentage Distribution of Species in Sample from Bore N.S. 48, 116 ft. 0½ in. to 118 ft. 4 in.

Species	Percentage
Sphagnumsporites australis	0·8
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	1·6
Sphagnumsporites adnatus	1·2
Lycopodium rosewoodensis	8·8
Lycopodium triangularis	0·6
Osmundacidites cf. *wellmanii*	A
Gleichenia cf. *circinidites*	0·2
Cyathidites parvus	A
Leptolepidites verrucatus	0·2
Leiotriletes directus	19·0
Leiotriletes magnus	0·6
Leiotriletes mortoni	0·6
Leiotriletes crassus	0·2
Granulatisporites minor	A
Cyclogranisporites breviradiata	1·2
Punctatisporites crassiradiata	0·2
Punctatisporites minimus	1·8
Verrucosisporites walloonensis	2·0
Verrucosisporites triangularis	A
Acanthotriletes pallidus	0·4
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	4·2
Annulispora densata	1·0
Pilasporites minutus	3·2
Pilasporites crassus	0·6
Marsupipollenites psilatus	A
Entylissa nitidus	7·0
Entylissa crassimarginis	0·4
Entylissa magna	0·2
Caytonipollenites contectus	A
Caytonipollenites subtilis	A
Araucariacites cf. *australis*	18·8
Inaperturopollenites reidi	
Inaperturopollenites sp.	2·0
Zonalapollenites dampieri	0·6
Zonalapollenites segmentatus	0·2
Pityosporites parvisaccatus	0·4
Pityosporites psilatus	0·2
Others	21·8

This spore assemblage shows the following distribution of the Key species:—*Sphagnumsporites clavus, Cingulatisporites granulatus, Caytonipollenites*

contectus and *C. subtilis* are all absent, and *Leiotriletes crassus* is relatively rare. The genus *Zonalapollenites* is present in significant proportions; in this respect the seam differs from the Rosewood No. 4 seam above, in which the genus is rare or absent. *Zonalapollenites* is also present in appreciable amounts in the New Malabar seam below, but the stratigraphic interval between the latter seam and the Rosewood No. 5 seam is sufficiently great to enable distinction in most cases.

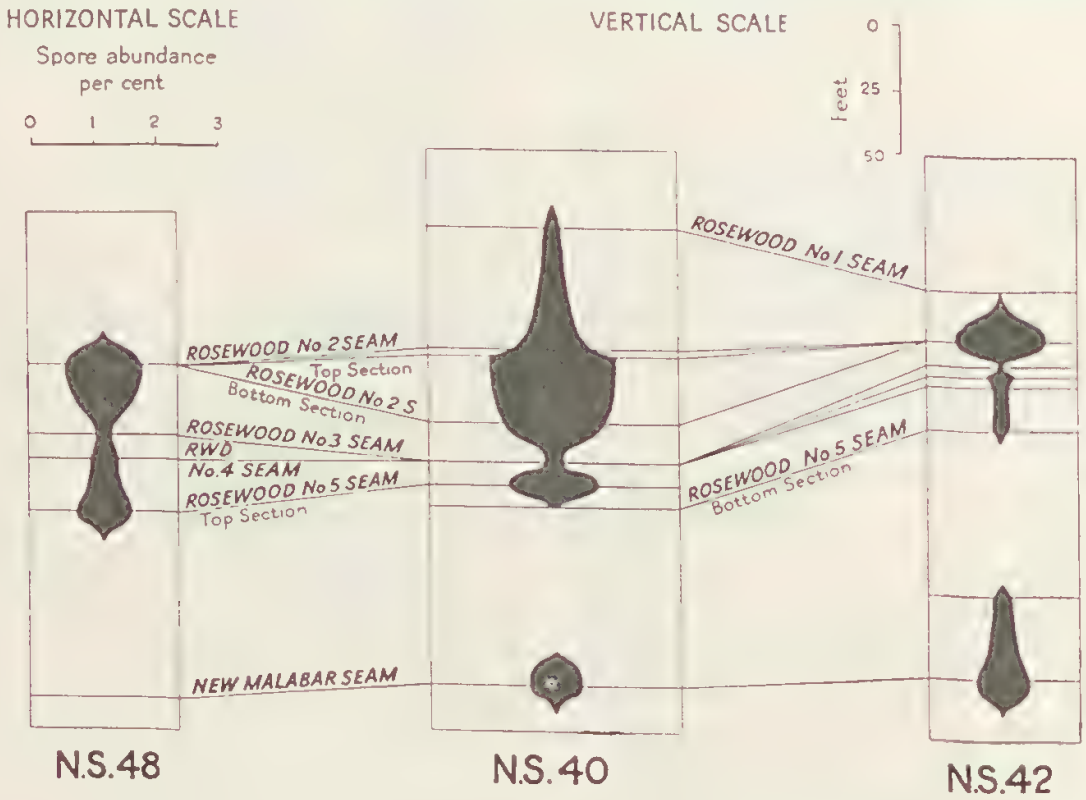
A seam in the same relative stratigraphic position with a similar spore assemblage has been studied in Bore N.S. 40, in the Normanton No. 1 mine area, and accordingly correlated with the Rosewood No. 5 seam. In this mine area the seam is clearly split into two sections and in N.S. 40 the two sections are approximately 5 ft. apart. In this bore the two sections were studied separately with regard to spore distribution. This examination indicated that *Zonalapollenites* is moderately abundant in, and characteristic of, the top section of the seam, being absent or relatively rare in the bottom section. The proportions are:—for the top section (230 ft. 8¼ in. to 232 ft. 11¼ in.)—1·4 per cent.; for the bottom section (238 ft. to 240 ft. 6½ in.)—absent. In Normanton No. 1 colliery the Rosewood No. 5 seam is known locally as the "Normanton No. 4" seam and its top section is the seam worked in the longwall section of the workings.

In the Oakleigh mine area the Rosewood No. 5 seam is represented by the section from 230 ft. 10 in. to 231 ft. 9 in. in Bore N.S. 42. *Zonalapollenites* is relatively rare in this section (0·2 per cent.), indicating that it is equivalent to the lower portion of the seam. The top section of the seam is evidently missing from the sequence in this bore, and has possibly been removed by contemporaneous erosion. In the air shaft and a prospecting bore at Oakleigh colliery there is a seam in this part of the sequence, known locally as the "Two-Foot" seam, which J. B. Cameron considers is equivalent to this section in N.S. 42 (verbal communication.)

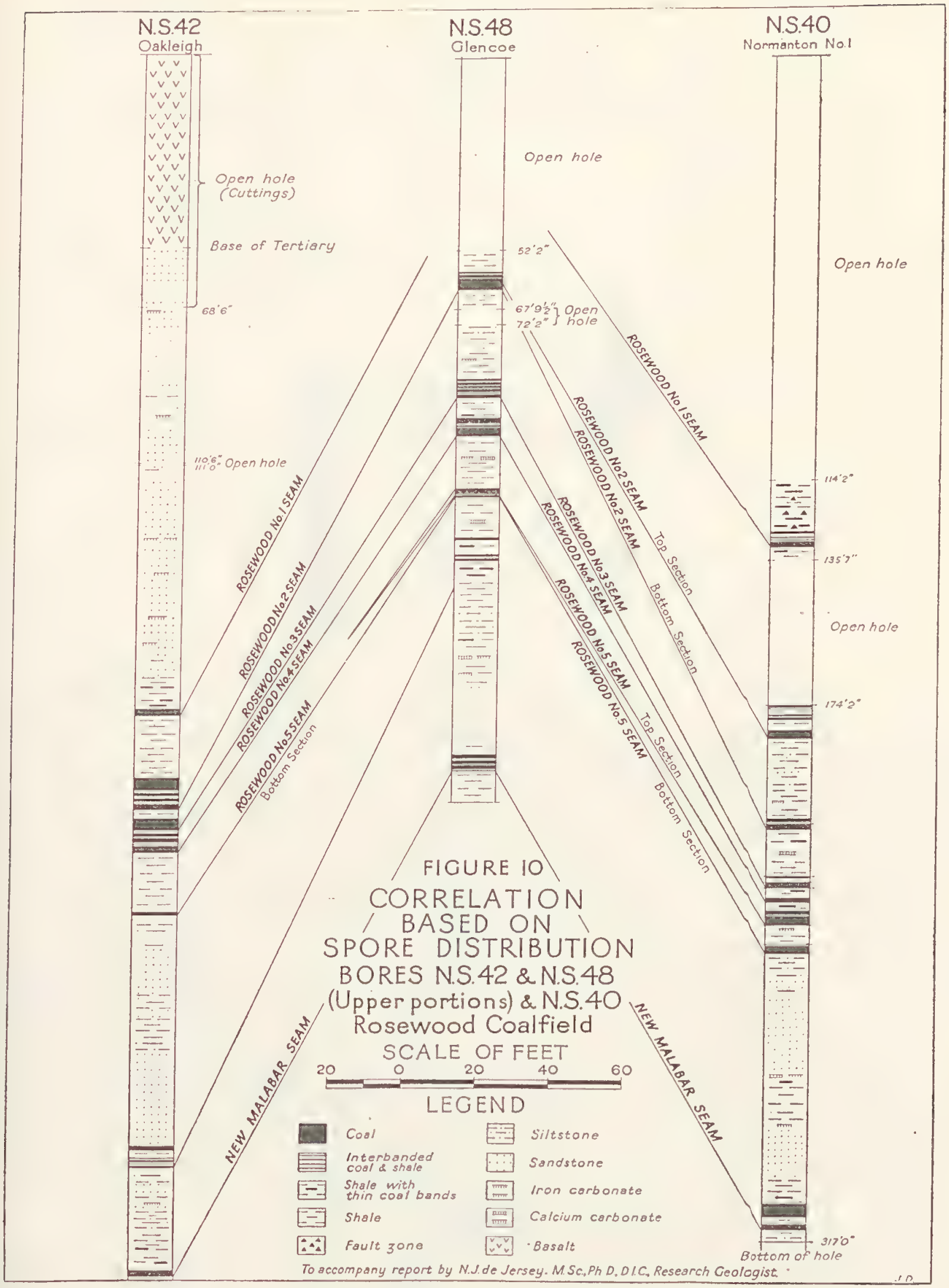
In Figures 9 and 10 is shown the application of the distribution of *Zonalapollenites* to correlation of the Rosewood No. 5 seam in Bores N.S. 48, N.S. 40 and N.S. 42, in the Glencoe, Normanton No. 1, and Oakleigh mine areas respectively.

In Bore N.S. 60, in the Mount Elliott mine area, the sections below the Rosewood Nos. 3 and 4 seams, tentatively correlated with the Rosewood No. 5 seam, are those from 91 ft. 4¼ in. to 93 ft. 1 in. and from 95 ft. 11½ in. to 100 ft. 1¼ in. The peak in the distribution diagram for *Zonalapollenites* for the top section of the seam is less pronounced in this bore, and considering the isolated position of this mine area and the lack of information on the intervening area,

Figure 9
Diagrams showing distribution of Zonalapollenites
as applied to seam correlation
Bores N.S.40 (Normanton No.1), N.S.42 (Oakleigh), & N.S.48 (Glencoe)



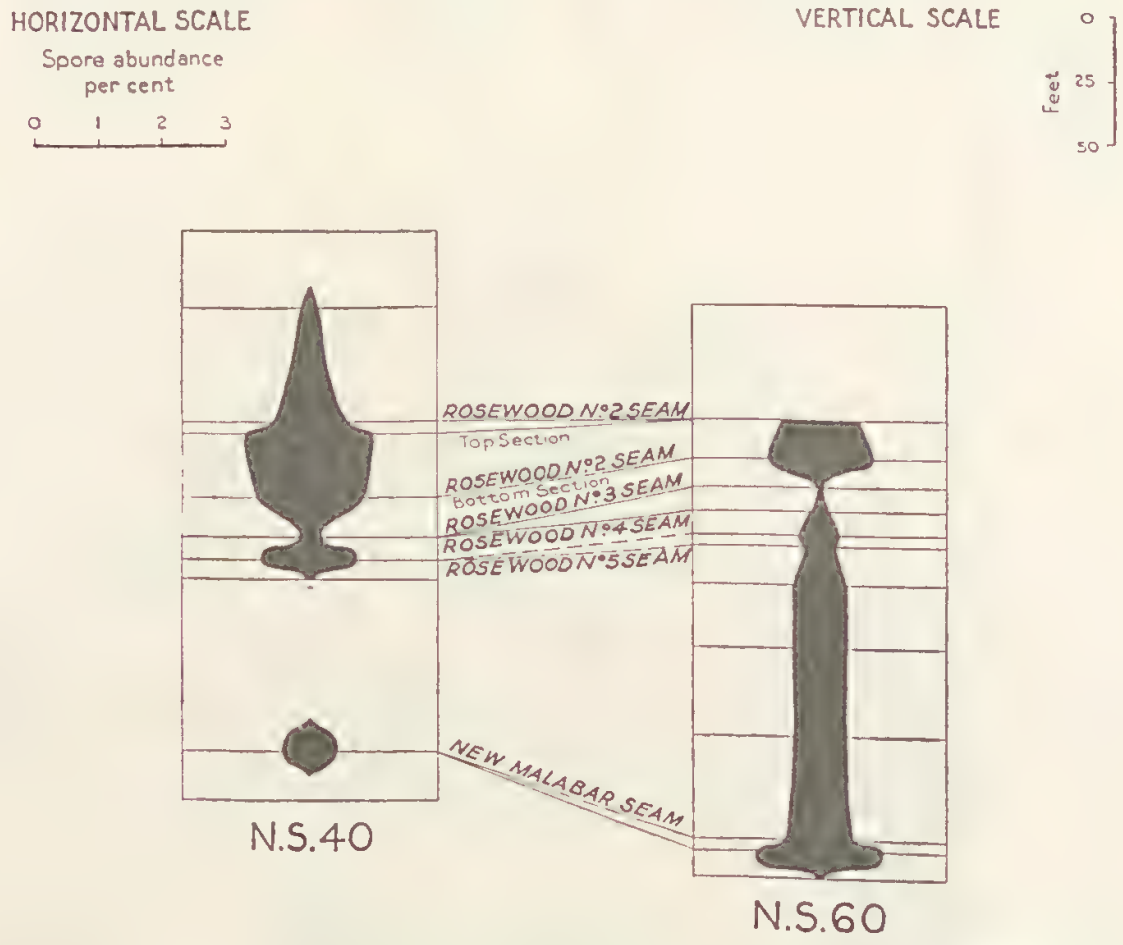
To accompany report by N.J. de Jersey, M Sc, Ph D, D.I.C., Research Geologist



To accompany report by N.J. de Jersey. M.Sc., Ph.D., D.I.C., Research Geologist.

J.D.

Figure 11
Diagrams showing distribution of Zonalapollenites as applied to seam correlation
Bores N.S.40 (Normanton No.1) & N.S.60 (Mt.Elliott)



To accompany report by N.J. de Jersey, M.Sc., Ph.D., D.I.C., Research Geologist.

the correlation should be regarded as provisional only. If this correlation is correct, it indicates a thickening to approximately 110 ft. of the interval between the seam and the New Malabar seam below and also an increased development of coal bands between the two seams. This tentative correlation is shown by a broken line in Figures 11 and 12.

The Rosewood group of seams has also been studied in Bore N.S. 84, in the Smithfield No. 3 mine area. In this bore no sections with the characteristic spore assemblages of the Rosewood No. 5 seam have been found, as in the relevant part of the succession (below the Rosewood Nos. 3 and 4 seams) there are only three thin coal bands (1 in. to 1½ in. in thickness) which have not been studied with regard to spore distribution. Consequently the characterised peak in abundance of *Zonalapollenites* for the top section of the seam in N.S. 40 is missing from the distribution diagram for N.S. 84 (see Figure 13). The spore distribution thus suggests that the Rosewood No. 5 seam has either lensed out to these thin coal bands or has been removed by faulting. The correlation of the Rosewood group of seams between N.S. 40 (Normanton No. 1 mine area) and N.S. 84 is indicated in Figure 14.

(xi.) Rosewood No. 4 Seam

The writer (de Jersey 1957a, p. 196) has redefined this seam on the basis of its occurrence at Glencoe colliery. It is there known locally as the "Glencoe No. 3" seam and is represented in Bore N.S. 48 by the section from 96 ft. 4¼ in. to 102 ft. 11¼ in. Its spore assemblage is distinguished from that of the top section of the Rosewood No. 5 seam by a marked decrease in abundance of *Zonalapollenites*.

According to J. B. Cameron (verbal communication) this seam can be correlated, on lithological evidence, with the seam named the Rosewood No. 4 seam by Reid (1922, p. 40) in the Oakleigh mine area. In Bore N.S. 42 at Oakleigh, this seam joins together with the overlying Rosewood No. 3 seam (which has a similar spore assemblage) to form a thick banded section (from 205 ft. 9 in. to 214 ft. 11½ in.). In the Normanton No. 1 mine area the two seams also come together and are represented by the section from 219 ft. 10 in. to 226 ft. 9¾ in. in N.S. 40. This combined section is there known locally as the "Normanton No. 3" seam.

The Rosewood No. 4 seam is from 5 to 15 feet above the Rosewood No. 5 seam in bores N.S. 40, N.S. 42, and N.S. 48. In other bores, particularly in the Normanton No. 1 mine area, the interval is even more marked.

FIGURE 12

CORRELATION BASED ON SPORE DISTRIBUTION BORES N.S.40 & N.S.60

Rosewood Coalfield

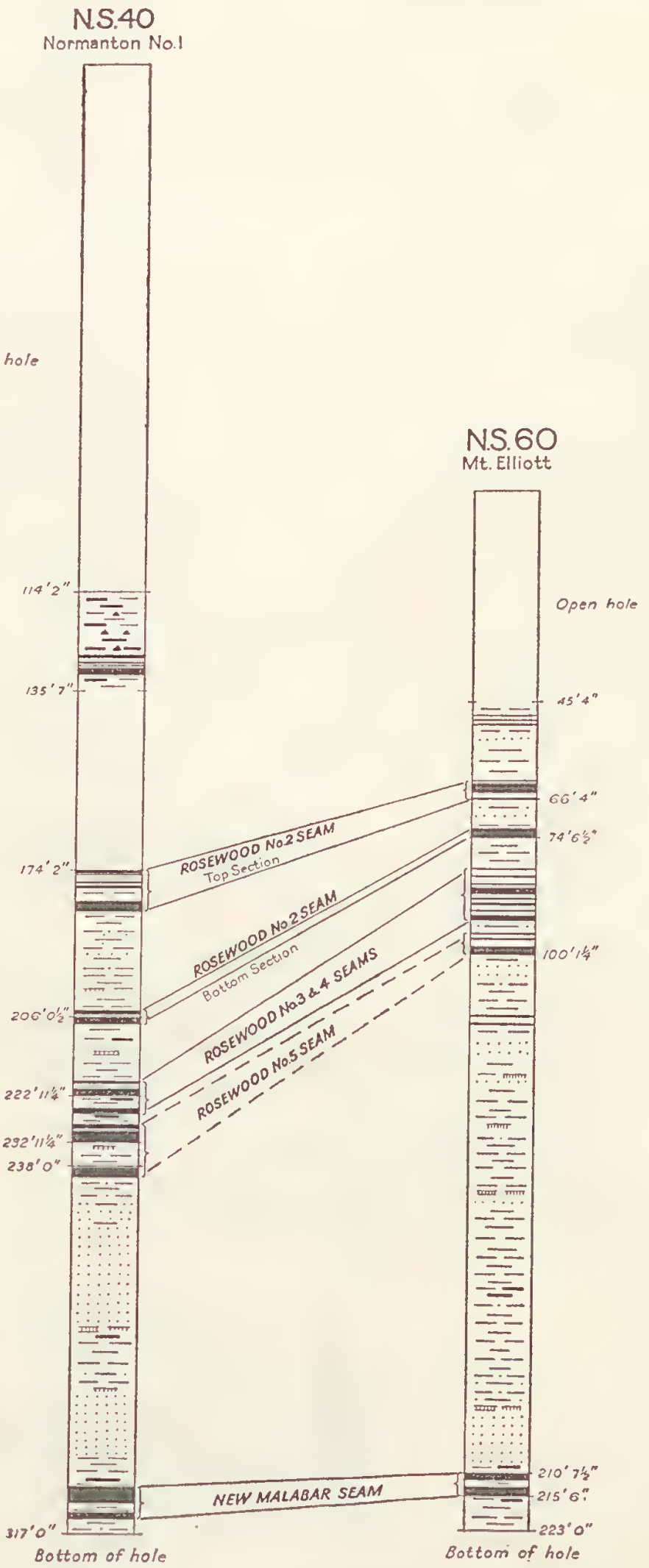
SCALE OF FEET

20 0 20 40 60

LEGEND

- Coal
- Interbanded Coal and Shale
- Shale
- Shale with thin Coal bands
- Siltstone
- Sandstone
- Iron Carbonate
- Calcium Carbonate
- Fault zone

To Accompany Report by N. J. de Jersey, M. Sc., Ph. D., D.I.C., Research Geologist.



J.D.

The spore assemblage given below (Table 11) is for the section from 96 ft. 4¼ in. to 102 ft. 11¼ in. in N.S. 48:—

TABLE 11

PERCENTAGE DISTRIBUTION OF SPECIES IN SAMPLE FROM BORE N.S. 48, 96 FT. 4¼ IN. TO 102 FT. 11¼ IN.

Species	Percentage
Sphagnumsporites australis	0·2
Sphagnumsporites clavus	0·2
Sphagnumsporites tenuis	1·2
Sphagnumsporites adnatus	A
Lycopodium rosewoodensis	6·4
Lycopodium triangularis	0·4
Osmundacidites cf. *wellmanii*	0·2
Gleichenia cf. *circinidites*	1·0
Cyathidites parvus	A
Leptolepidites verrucatus	0·2
Leiotriletes directus	18·0
Leiotriletes magnus	0·6
Leiotriletes mortoni	A
Leiotriletes crassus	0·2
Granulatisporites minor	A
Cyclogranisporites breviradiata	0·8
Punctatisporites crassiradiata	A
Punctatisporites minimus	0·2
Verrucosisporites wallonensis	1·4
Verrucosisporites triangularis	A
Acanthotriletes pallidus	0·6
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	3·6
Annulispora densata	0·4
Pilasporites minutus	2·2
Pilasporites crassus	0·2
Marsupipollenites psilatus	A
Entylissa nitidus	4·4
Entylissa crassimarginis	A
Entylissa magna	A
Caytonipollenites contectus	A
Caytonipollenites subtilis	0·2
Araucariacites cf. *australis*	39·0
Inaperturopollenites reidi	
Inaperturopollenites sp.	1·8

TABLE 11—*continued*

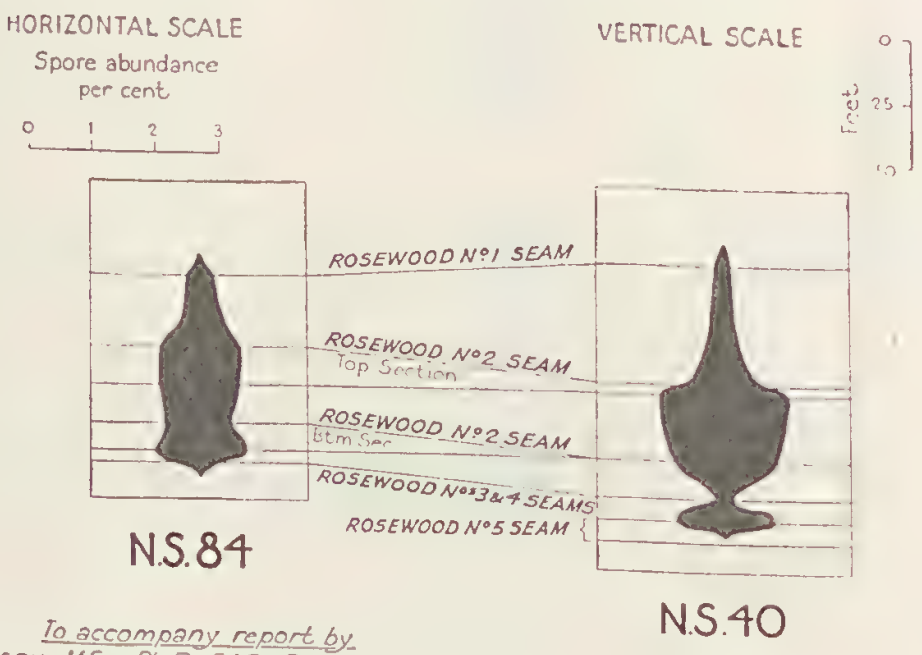
PERCENTAGE DISTRIBUTION OF SPECIES IN SAMPLE FROM BORE N.S. 48, 96 FT. 4¼ IN. TO 102 FT. 11¼ IN.—*continued*

Species	Percentage
Zonalapollenites dampieri	0·2
Zonalapollenites segmentatus	A
Pityosporites parvisaccatus	0·2
Pityosporites psilatus	0·2
Others	16·0

As stated above, the spore assemblage of this seam is characterised by the rarity or absence of *Zonalapollenites*. All the other Key species are either absent or relatively rare. This spore assemblage thus distinguishes the seam from the top section of the Rosewood No. 5 seam immediately below, but owing to similarity in the assemblages, distinction from the Rosewood No. 3 seam is not possible on the basis of spore distribution alone. This difficulty of separating the Rosewood Nos. 3 and 4 seams is further emphasised by the fact that they frequently join together to form a thick, continuous banded section. This is the case in Bore N.S. 42 in the Oakleigh mine area, and in Bore N.S. 40 (Normanton No. 1 mine area). The correlation of Bores N.S. 48, N.S. 42, and N.S. 40 is shown diagrammatically in Figures 9 and 10.

In Bore N.S. 84, in the Smithfield No. 3 mine area, the Rosewood Nos. 3 and 4 seams are represented by the banded section from 235 ft. 0¼ in. to 238 ft. 2½ in. This correlation is illustrated by the spore distribution and correlation diagrams (Figures 13 and 14). In the Mount Elliott mine area, as represented by Bore N.S. 60, two seams in the relevant portion of the succession exhibit the spore assemblage of the Rosewood Nos. 3 and 4 seams. These are the

Figure 13
Diagrams showing distribution of Zonalapollenites as applied to seam correlation
Bores N.S.40 (Normanton No1) & N.S. 84 (Smithfield No.3)



To accompany report by
N.J de Jersey, M.Sc., Ph.D., D.I.C., Research Geologist

FIGURE 14

CORRELATION BASED ON SPORE DISTRIBUTION.

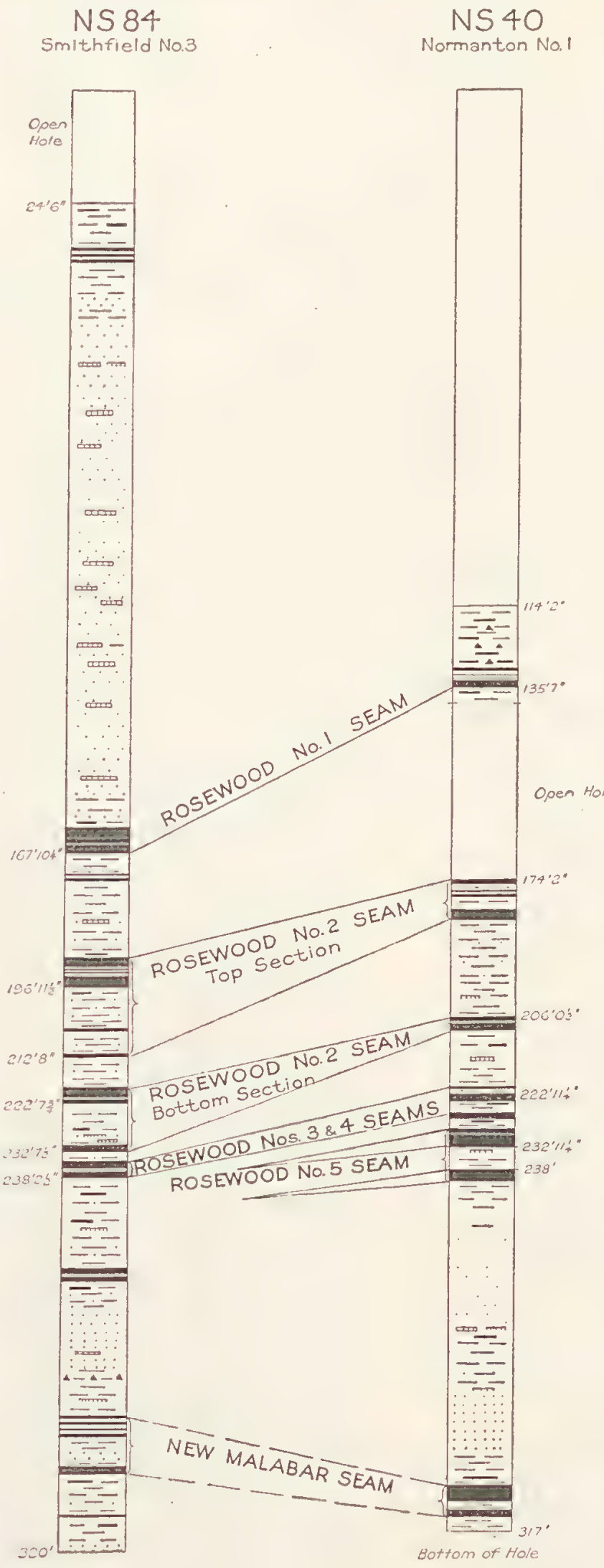
BORES N.S. 84 (Upper Portion) AND N.S. 40

Rosewood Coalfield

LEGEND

- Coal
- Interbanded Coal and Shale
- Shale
- Shale with thin Coal bands
- Siltstone
- Sandstone
- Iron Carbonate
- Calcium Carbonate
- Fault zone

To Accompany Report by N.J. deJersey, M.Sc., Ph.D., D.I.C., Research Geologist.



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sections from 72 ft. 9 in. to 74 ft. 6½ in. and from 82 ft. 6½ in. to 90 ft. 11¼ in. in N.S. 60. On this basis, the lower section, with only 0·2 per cent. of *Zonalapollenites*, is considered to be partly or wholly equivalent to the Rosewood No. 4 seam. This is illustrated in Figures 11 and 12.

(xii) Rosewood No. 3 Seam

As indicated above, this seam has been re-defined on the basis of its occurrence at Glencoe colliery. It is there known locally as the "Glencoe No. 2" seam and is represented in Bore N.S. 48 by the coal section from 86 ft. 6 in. to 92 ft. 1 in. Like the Rosewood No. 3 seam below the spore population is characterised by the relative rarity of *Zonalapollenites*.

According to J. B. Cameron (verbal communication) the correlation of this seam with the seam named the Rosewood No. 3 seam by Reid at Oakleigh (Reid 1922, p. 40) is well established. The two seams are separated by 10 ft. of sandstone in the section recorded by Reid but, as described above (under the Rosewood No. 4 seam), come together to form one continuous banded section in Bore N.S. 42 and also in the Normanton No. 1 mine area.

The following representative spore assemblage is that from Bore N.S. 48 (86 ft. 6 in. to 92 ft. 1 in.):—

TABLE 12

Percentage Distribution of Species in Sample from Bore N.S. 48, 86 ft. 6 in. to 92 ft. 1 in.

Species	Percentage
Sphagnumsporites australis	A
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	0·8
Sphagnumsporites adnatus	0·4
Lycopodium rosewoodensis	6·6
Lycopodium triangularis	0·2
Osmundacidites cf. *wellmanii*	0·2
Gleichenia cf. *circinidites*	0·6
Cyathidites parvus	A
Leptolepidites verrucatus	0·6
Leiotriletes directus	14·6
Leiotriletes magnus	0·4
Leiotriletes mortoni	A
Leiotriletes crassus	A
Granulatisporites minor	A
Cyclogranisporites breviradiata	1·0
Punctatisporites crassiradiata	A
Punctatisporites minimus	0·8
Verrucosisporites walloonensis	1·0
Verrucosisporites triangularis	0·2
Acanthotriletes pallidus	0·4
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	4·0
Annulispora densata	0·4
Pilasporites minutus	3·2
Pilasporites crassus	0·2
Marsupipollenites psilatus	A
Entylissa nitidus	7·0
Entylissa crassimarginis	A
Entylissa magna	0·2
Caytonipollenites contectus	0·2
Caytonipollenites subtilis	A
Araucariacites cf. *australis*	33·2
Inaperturopollenites reidi	
Inaperturopollenites sp.	1·8
Zonalapollenites dampieri	0·2
Zonalapollenites segmentatus	A
Pityosporites parvisaccatus	0·2
Pityosporites psilatus	0·2
Others	21·4

As indicated above, this spore assemblage resembles that of the Rosewood No. 4 seam below in the relative rarity of *Zonalapollenites* (0·2 per cent.). The resemblance is further emphasised by the rarity or absence of all the other Key species. On the other hand, there is a ready distinction from the Rosewood No. 2 seam above, in which *Zonalapollenites* is in significant proportions.

The correlation of this seam with the upper parts of the continuous banded sections (from 205 ft. 9 in. to 214 ft. 11½ in. in N.S. 42, Oakleigh mine area) and from 221 ft. 6¼ in. to 222 ft. 11¼ in. in N.S. 40, Normanton No. 1 mine area, has already been discussed above under the Rosewood No. 4 seam. In Bore N.S. 84, in the Smithfield No. 3 mine area, the position is similar, and accordingly the correlation is indicated of the upper part of the section from 235 ft. 0¼ in. to 238 ft. 2½ in. in this bore with the Rosewood No. 3 seam. In this section the proportion of *Zonalapollenites* is 0·4 per cent. This correlation is indicated in Figures 13 and 14.

The Rosewood No. 3 seam is also considered to be represented in the Mount Elliott mine area. In Bore N.S. 60, in this mine, *Zonalapollenites* is absent from the section between 72 ft. 9 in. and 74 ft. 6½ in. which is immediately below the seam correlated with the Rosewood No. 2 seam, and accordingly this section is correlated with the Rosewood No. 3 seam. This is illustrated in Figures 11 and 12.

(xiii) Rosewood No. 2 Seam

J. H. Reid (1922, p. 40) named this seam and described it from sections measured in both Perry's Nob (now Oakleigh), and Glencoe collieries. The type section at Oakleigh forms part of the section from 194 ft. 10 in. to 203 ft. 4 in. in N.S. 42. The spore assemblage of this section is given below in Table 13:—

TABLE 13

Percentage Distribution of Species in Sample from Bore N.S. 42, 194 ft. 10 in. to 203 ft. 4 in.

Species	Percentage
Sphagnumsporites australis	0·8
Sphagnumsporites clavus	0·2
Sphagnumsporites tenuis	0·6
Sphagnumsporites adnatus	0·8
Lycopodium rosewoodensis	1·8
Lycopodium triangularis	0·2
Osmundacidites cf. *wellmanii*	0·2
Gleichenia cf. *circinidites*	1·0
Cyathidites parvus	0·4
Leptolepidites verrucatus	0·4
Leiotriletes directus	20·0
Leiotriletes magnus	1·4
Leiotriletes mortoni	A
Leiotriletes crassus	A
Granulatisporites minor	A
Cyclogranisporites breviradiata	0·4
Punctatisporites crassiradiata	A
Punctatisporites minimus	A
Verrucosisporites walloonensis	1·0
Verrucosisporites triangularis	A
Acanthotriletes pallidus	0·2
Rugulatisporites ramosus	0·2
Cingulatisporites granulatus	A
Annulispora folliculosa	1·4
Annulispora densata	0·2
Pilasporites minutus	4·6

TABLE 13—*continued*

Species	Percentage
Pilasporites crassus	0·2
Marsupipollenites psilatus	0·2
Entylissa nitidus	4·2
Entylissa crassimarginis	0·6
Entylissa magna	0·2
Caytonipollenites contectus	0·2
Caytonipollenites subtilis	A
Araucariacites cf. *australis*	33·2
Inaperturopollenites reidi	
Inaperturopollenites sp.	4·6
Zonalapollenites dampieri	0·4
Zonalapollenites segmentatus	1·0
Pityosporites parvisaccatus	0·4
Pityosporites psilatus	A
Others	19·0

The spore assemblage of this seam is distinguished from those of the Rosewood No. 3 seam below and the Rosewood No. 1 seam above by the presence of significant proportions of *Zonalapollenites* (1–2 per cent.). Apart from this, all the other key species are relatively rare or absent. On this basis, the seam can be correlated with the section in Glencoe colliery (from 57 ft. 9½ in. to 62 ft. 6 in. in N.S. 48), known locally as the Little Glencoe seam. The correlation is in agreement with Reid's correlation (1922, p .43) based on seam sections.

In Bore N.S. 40, adjacent to Normanton No. 1 colliery, the Rosewood No. 2 seam is split into two sections separated by over 20 ft. of shale and sandstone. These sections, both of which have the characteristic spore assemblage of the seam, are known locally as the Normanton No. 1 and Normanton No. 2 seams. This splitting of the seam was noted within the Normanton No. 1 workings by J. H. Reid who stated (1927, p. 6) "the sandstone and shale dividing No. 1 and 2 seams thickens from 8 in. to 9 ft. going north in the course of several chains." The strata dividing the two coal sections evidently thicken still further going further north to N.S. 40. The above correlations (between N.S. 40, N.S. 42, and N.S. 48) are illustrated diagrammatically in Figures 9 and 10.

Study of spore assemblages in Bore N.S. 60, in the Mount Elliott mine area, indicates that in this bore the Rosewood No. 2 seam is also split into two sections. These are the sections from 46 ft. 5½ in. to 49 ft. 11¾ in. and from 61 ft. 6½ in. to 66 ft. 4 in. The proportions of *Zonalapollenites* in these sections are 1·6 and 1·2 per cent. respectively. The correlation between Bores N.S. 60 and N.S. 40 (taken as representative of the succession in the Perry's Nob area) is shown in Figures 11 and 12.

In Bore N.S. 84, in the Smithfield No. 3 mine area, the characteristic spore asemblage can be recognised in four of the sections studied; these are from 190 ft. 11¼ in. to 196 ft. 11½ in.; 205 ft. 3 in. to 212 ft. 8 in.; 219 ft. 4¾ in. to 222 ft. 7¾ in. and 231 ft. 8 in. to 232 ft. 7½ in. This spore distribution indicates that the splitting of the seam evident in N.S. 40 is still more pronounced in N.S. 84, the top and bottom coal sections each splitting again into two or more sections so that the whole seam is represented by a succession of coal and stone bands extending over a vertical thickness of approximately 40 ft. According to J. B. Cameron (verbal communication) the bottom seam worked in Smithfield No. 3 colliery is equivalent to the upper part of this succession, being represented by the section from 190 ft. 11¼ in. to 196 ft. 11½ in., and the two coal bands from 205 ft. 3 in. to 106 ft. 10 in. and from 211 ft. 8 in. to 212 ft. 8 in. These two coal bands were combined into one sample for study of spore distribution. The correlation of Bores N.S. 40 and N.S. 84 is illustrated diagrammatically in Figures 13 and 14.

(xiv) Rosewood No. 1 Seam

This seam was named by J. H. Reid (1922, p. 43) from its occurrence at Glencoe colliery. Unfortunately the section examined by Reid is no longer accessible but its correlation with the section from 176 ft. 6¼ in. to 178 ft. 3¼ in. in N.S. 42 (in the Oakleigh mine area) is well established on stratigraphic evidence. Owing to its proximity to the surface no core was recovered from the seam in N.S. 48 in the Glencoe mine area. Accordingly the section in N.S. 42 is taken as representative of the seam, and its spore assemblage is given below (Table 14):—

TABLE 14

Percentage Distribution of Species in Sample from Bore N.S. 42, 176 ft. 6¼ in. to 178 ft. 3¼ in.

Species	Percentage
Sphagnumsporites australis	0·2
Sphagnumsporites clavus	A
Sphagnumsporites tenuis	0·2
Sphagnumsporites adnatus	0·6
Lycopodium rosewoodensis	0·6
Lycopodium triangularis	A
Osmundacidites cf. *wellmanii*	A
Gleichenia cf. *circinidites*	0·2
Cyathidites parvus	0·2
Leptolepidites verrucatus	A
Leiotriletes directus	20·0
Leiotriletes magnus	3·0
Leiotriletes mortoni	A
Leiotriletes crassus	0·2
Granulatisporites minor	0·2
Cyclogranisporites breviradiata	0·4
Punctatisporites crassiradiata	0·2
Punctatisporites minimus	A
Verrucosisporites walloonensis	0·6
Verrucosisporites triangularis	0·2
Acanthotriletes pallidus	A
Rugulatisporites ramosus	A
Cingulatisporites granulatus	A
Annulispora folliculosa	1·4
Annulispora densata	0·4
Pilasporites minutus	3·0
Pilasporites crassus	0·2
Marsupipollenites psilatus	A
Entylissa nitidus	5·6
Entylissa crassimarginis	0·6
Entylissa magna	A
Caytonipollenites contectus	A
Caytonipollenites subtilis	A
Araucariacites cf. *australis*	45·0
Inaperturopollenites reidi	
Inaperturopollenites sp.	4·6
Zonalapollenites dampieri	A
Zonalapollenites segmentatus	A
Pityosporites parvisaccatus	0·2
Pityosporites psilatus	A
Others	12·2

The spore assemblage of this seam is characterised by the rarity or absence of *Zonalapollenites,* which enables distinction from the Rosewood No. 2 seam below, in which that genus is present in significant proportions. All the remaining Key species are relatively rare or absent. On this basis the seam in N.S. 42 is correlated with a section from 130 ft. 9¼ in. to 131 ft. 6¼ in. in Bore N.S. 40, in the Normanton No. 1 mine area. The proportion of *Zonalapollenites* in this section is 0·2 per cent. This correlation is illustrated in Figures 9 and 10.

In Bore N.S. 84, in the Smithfield No. 3 mine area, the seam is represented by the section from 162 ft. 5½ in. to 167 ft. 10¼ in., which is equivalent to the top seam worked in Smithfield No. 3 colliery. This correlation is shown diagrammatically in Figures 13 and 14. The Rosewood No. 1 seam has not been recognised in Bore N.S. 60, in the Mount Elliott mine area. In this bore the relevant portion of the succession is so close to the surface that no coal cores were recovered.

In the Oakleigh and Glencoe areas the Rosewood Nos. 1 and 2 seams are approximately 16 ft. apart. In an easterly direction towards Normanton No. 1, this interval thickens to over 40 ft. in N.S. 40 (see Figure 10). The Rosewood No. 1 seam is normally overlain by a considerable thickness of barren strata, namely sandstone, without any persistent coal seams. This is the case in Bores N.S. 42 and N.S. 84, where the thickness of this sandstone reaches approximately 120 ft. In Bore N.S. 84 there is a coal seam above this sandstone (at 34 ft. 8½ in.) which represents a coal horizon stratigraphically higher than any previously studied in the coalfield. Unfortunately this seam was too badly weathered to permit study of its spore assemblage, both in N.S. 84 and in the other bores drilled in the Smithfield No. 3 mine area.

5. Conclusions

This investigation has established the percentage distribution of the forty species of spores and pollen grains described previously (de Jersey 1958b) in the principal seams of the Rosewood coalfield. The distribution of these species has been studied both vertically, in terms of the stratigraphic succession, and laterally, to explore lateral variation in the spore assemblages, the purpose being to examine the application of spore distribution in seam correlation. It has been found that the majority of the species, particularly dominant forms such as *Inaperturopollenites reidi* and *Leiotriletes directus,* do not show marked or significant changes in their proportions in the vertical succession, and that the spore assemblages do not show the striking changes from one seam to the next such as have been recorded from Carboniferous coals—for example the Illinois coals described by Kosanke (1950). This may be related to conditions of deposition, as the Carboniferous coal measures were largely paralic in nature, and the alternation of fresh-water and marine environments may have stimulated changes in the composition of the floras, while in the Walloon coal measures, which are entirely of fresh-water origin, the absence of striking changes in the seam assemblages may be a reflection of the general uniformity of environmental conditions. In addition, the relative thinness of the productive section of the coal measures (approximately 500 ft. in the Rosewood district) reduces the time available for changes in the composition of the floras due to evolution or other environmental factors.

As a result of this relative uniformity of the microfloras, detailed study of the spore assemblages has been necessary to discover species which show significant changes in their proportions in the succession, and could this be of correlative value. Seven of the less common species have been found which fulfil this condition. For each of these species the evidence indicates that the distribution pattern is persistent laterally, thus establishing their correlative value, and accordingly they have been described as "Key species." The use of these species in correlation is discussed above under the headings of the individual seams. Perhaps the most noteworthy of these, from the aspect of correlation, are the two species of *Caytonipollenites.* This genus is present in significant proportions (1 to 4 per cent.) in the lower portion of the productive coal measures, while in the upper portion it is relatively rare or absent, its proportion being 0·2 per cent. or less. The change in the proportion of this genus takes place in the United No. 8 Top seam. In the lower section of this seam, as exemplified in Bore N.S. 42, its proportion is 3·8 per cent., while in the upper section it forms only 0·2 per cent. of the assemblage. This sharp change should enable a division of the productive portion of the coal measures into two zones of approximately equal thickness but such a division is not proposed until further work is carried out on lateral persistence of these assemblages.

With regard to correlation of individual seams, the investigation has indicated that the proportions of the Key species will either enable identification of an unknown seam, or enable it to be placed in a relatively restricted portion of the coal measures. Correlation of seams is facilitated when two vertical successions are available for comparison, as in such cases it can be based on comparison of the vertical distribution patterns of the Key species.

There is considerable scope for future research on spore distribution in this coalfield. Such research could include (1) the extension of spore distribution studies to areas not included in the present investigation, for example to the abandoned collieries in the Purga-Loamside area, (2) the detailed study of assemblages, band by band, through the sections of the principal seams and (3) the investigation of the spore content of the shale and sandstone beds between the coal seams.

6. Acknowledgements

This investigation has been facilitated by the ready co-operation of Mr. J. B. Cameron, Geologist, Geological Survey of Queensland. Mr. Cameron, who has exercised geological supervision over the Departmental drilling programme in the Rosewood coalfield

in recent years, has assisted in the selection of coal samples for study and has offered helpful advice on correlation problems.

Mr. I. G. Sanker, Geologist, Geological Survey of Queensland, also assisted in the preparation of the map and other diagrams illustrating this report.

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THE BURRUM COALFIELD

By W. L. HAWTHORNE, B.Sc., Geologist

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PREFACE

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Following recommendations made by Messrs. Powell-Duffryn Technical Services Ltd. for the development of Queensland coalfields, the Department of Mines commenced diamond drilling to prove reserves in the Burrum Coalfield in 1950.

Reports setting out the results of drilling have been published from time to time in the Queensland Government Mining Journal.

Concurrently with the direction of Departmental drilling, still in progress, Mr. Hawthorne has geologically mapped an area of some 1,000 square miles, embracing the Mesozoic formations of the district. Of this area, approximately one third, occupied by Lower Cretaceous sediments has been examined in detail.

As a result of this work, considerable advance has been made in our knowledge of the Mesozoic succession in the area and the more detailed structure of the Maryborough Basin.

As part of his investigation, Mr. Hawthorne undertook a comprehensive review of mining and prospecting operations on the field since commencement of production. Study of accumulated data has enabled the best use to be made of the diamond drill in locating and proving workable areas in advance of mining.

Combined shallow drilling by operating companies and diamond drilling by the Department have proved five mine areas on the eastern limb of the Burrum Syncline. With the approaching exhaustion of targets in this area, prospecting based on recent geological mapping will necessarily be extended to other synclinal areas not as yet adequately prospected. This report provides a concrete basis for the assessment and testing of such areas.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

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THE BURRUM COALFIELD

By W. L. HAWTHORNE, B.Sc., Geologist

INTRODUCTION

Since 1950 the writer has been associated with a programme of exploration for coal in the Burrum Coalfield being conducted by the Queensland Department of Mines. During this time the cores obtained from over sixty diamond drill holes, ranging up to 1,000 ft. in depth, bored in various parts of the producing area were critically examined and the stratigraphical positions of the coal seams penetrated were determined. All accessible colliery workings were inspected and close liaison was maintained with the non-coring drilling programmes being conducted by the companies operating in the district. In addition to these investigations which were concerned solely with exploration in the present producing area the potentially productive area west of Howard was examined by creek traverses and the Maryborough Formation was mapped in some detail. The Mesozoic formations underlying the Maryborough Formation were also examined but by reconnaissance traverses only.

This report deals with an area of approximately 1,000 square miles bounded by a north-south line passing through Bodalla, an east-west line passing through Traviston, Hervey Bay, and an east-west line passing through Thinoomba. Of this area approximately one-third is occupied by the Burrum Coal Measures and the Maryborough Formation. This has been examined in detail, and reconnaissance traverses have been made across the rest of the area.

The first part of this report deals with the regional geology which was last discussed by Dunstan (1918 and 1919) and Bryan and Massey (1926). In this section the information now available concerning the Burrum Coal Measures and the Maryborough Formation is presented. The underlying formations are dealt with briefly as a background for discussion of igneous activity and geological history. Some of these formations have been re-named or re-defined to comply with the terms of the Australian Code of Stratigraphic Nomenclature.

In the second part of the report, which gives in some detail a geological and historical account of the collieries in the field, the later information now available has been added to that given in the earlier reports by Rands (1886) and Ball (1902).

A geological map of the whole area and a cross-section (Figure 1) accompany the report; and in addition there are plans of the working areas of the coalfield (Figure 2) and diagrams showing generalised bore logs (Figures 3, 4 and 5). Seam correlations are shown diagrammatically on Figures 3, 4 and 5.

I am indebted to the managers of the various collieries for their co-operation and assistance. Of particular value is the information obtained by the Burgowan Coal Company during their prospecting campaign which has been made available to the Geological Survey.

LOCATION AND ACCESS

The Burrum Coal Measures occupy a coastal strip up to 25 miles in width extending from Maryborough north-westerly to Baffle Creek. Coal production is confined to the southern portion of this area near the towns of Howard, Torbanlea and Colton. This producing area is traversed by the North Coast Railway and the Bruce Highway and is connected by rail to port facilities at Urangan, approximately 20 miles distant.

TOPOGRAPHY

Throughout the whole area there is a gentle regional slope to the north-east (i.e. towards the coast). This slope is interrupted by a series of discontinuous, relatively high, sub-parallel ridges where heights range up to 300 ft. above sea level. These ridges which mark resistant beds in the Maryborough Formation trend north-north-west.

Red soil residuals and Tertiary volcanics in the neighbourhood of Childers also add relief to an otherwise almost featureless area.

The drainage system has two main outlets, the Mary and Burrum Rivers. The Burrum River and its tributaries—the Cherwell, Isis and Gregory Rivers—normally comprise only strings of disconnected waterholes except in their tidal reaches.

HISTORY OF DEVELOPMENT OF THE BURRUM COALFIELD

The Burrum Coalfield was the second producing field in Queensland. Outcrops in the banks of the Burrum River first attracted notice about 1865, in which year a Mr. Miller is reported to have used this coal in his sawmill (Fryar, 1900). Apparently the first person to mine coal for sale successfully was a Mr. Steley who worked a day level from the west bank of the river; about the same time the Watson Family were producing coal by similar methods on the east side of the river.

Following a decision by the Government allowing private individuals to select land for coal mining, the Queensland Land and Coal Company commenced operations at Burrum Colliery. Shortly afterwards the Torbanlea Colliery was opened. The Queensland Land and Coal Company, which was formed in London as

Wallum Country east of Torbanlea.

the result of efforts of two local men, Whitley and Howard, became Queensland Collieries Company Limited in 1885 and is still operating in the area. The Torbanlea Colliery was originally operated by Mr. J. Robertson, and was worked intermittently under the control of various companies and syndicates till it was finally closed in 1929.

Prior to construction of the railway between Howard and Maryborough in 1884, the coal was transported down the Burrum River by schooner. The cheaper transport provided by the railway led to an increase in the number of miners from 31 in 1884 to 182 by 1886. Rands (1886) reported that by 1886 the demand for coal in the district was greater than could be met.

The Dundee Coal Company was formed in 1909 to re-open the Dudley Shaft which had been sunk by the Burrum Co-operative Company in 1886 and subsequently closed. The Dundee Coal Company later gave rise to Howard Collieries Pty., another of the three companies still operating on the Burrum Field.

A further phase in the development of the field began in 1910 with the opening of the first Burgowan Colliery. Although numerous prospecting ventures had been launched, particularly in the late 1880's, mining had been restricted to the Torbanlea and Howard areas prior to the opening of this colliery which was located about 3 miles north-east of Torbanlea. The syndicate of miners who were leasing the colliery later purchased it and the Burgowan Coal Pty. Ltd. and the Burgowan Coal Co. were subsequently formed.

Queensland Collieries Co. Ltd. commenced operations on the eastern side of the Burrum River in 1922 when Quentin Colliery was opened adjacent to Burgowan No. 7 Colliery and on the same seam. This company gradually transferred its interests to the east side of the river and in 1927, with the flooding of Bellefield Colliery, mining ceased in the Howard area. A small colliery, Rankin, was established near the old pits north of Howard in 1952, but closed after production of a small tonnage. A new colliery, Burgowan No. 11, now being developed to the north of the old Queensland Collieries' Co. pits, is the only mine now being worked in the Howard area.

Mining in the Torbanlea section of the field continued intermittently till 1939 when the Wilston Colliery owned by Howard Collieries Pty. was closed. After this, production was for many years confined to the area north-east of Torbanlea. In 1946 Howard Collieries Pty. opened up a new locality by establishing Churchill Colliery south of the Pialba-Urangan Branch Railway between Colton and Takura. A second colliery, Globe, was established by the same company in this locality in 1951.

The recent opening of the Wide Bay and Burnett Regional Board's powerhouse at Howard has increased the local consumption of coal and a further increase is expected when this powerhouse is operating at its maximum capacity. Stability of coal production is therefore necessary and consequently the proving of ample reserves is highly desirable. The proving of such reserves is complicated because of the lenticular nature of the workable coal.

A diamond drilling programme was initiated by the Department of Mines in 1950 to assist the companies in prospecting the seams, deep drilling being

done mainly in potential mine areas where shallow handboring by the various companies located promising seams. Exceptions to this were the P.D.T.S. No. 1, Portland No. 2 and Globe Mine Areas where deep drilling was done ahead of existing collieries. The greater part of the outcrop area of the producing seams has now been tested by shallow boring (up to 100 ft.) with disappointing results, and one company has modified its prospecting method to drill to depths of up to 400 ft. to test seams proved unworkable at shallower depths. Such prospecting has already led to the establishment of one new colliery and it is expected that further promising areas will be located by this means. Numerous thin seams not worked previously are also to be prospected.

At the present time the three companies are operating five collieries. Of these, two are located north-east of Torbanlea, two between Colton and Takura, and one north of Howard. During the calendar year 1956, a total of 309 men were employed in the industry for a total production of 132,852 tons of coal.

PREVIOUS WORK

The earliest reference to the geology of the Wide Bay area is in the "Fifteenth Report to the Colonial Secretary upon the Geological and Mineralogical Structure of the Colony of New South Wales" by the first Geological Surveyor, Samuel Stutchbury (1856). Stutchbury traversed the whole of the Mesozoic succession in this area, but did not cross the present productive area of the Burrum Coalfield. Traverses from Maryborough to Port Curtis were done by Stutchbury's assistant, C. W. Birch, who observed granites and metamorphics to the south of Childers, and coal measures along the Burnett River. A suite of fossils from the Maryborough marine beds was collected by Stutchbury and named but no distinction was drawn in his mapping or text between marine and freshwater beds.

Daintree (1872) placed the freshwater beds at Burrum in the Jurassic, underlying the marine Maryborough beds which were placed by Etheridge, Senr. (in an appendix to the same paper) in the Lower Cretaceous. The coal measures of the Burrum and Tiaro areas were not recognised as separate formations and this led to an erroneous conception of the relationship between the Burrum and Maryborough beds which persisted till 1911.

A. C. Gregory (1875) correlated the Burrum Coals (including the present Tiaro Formation) with the Brisbane River Coal Beds. In a second report (1879A) he equated the Burrum Coals to the Newcastle Coals of Palaeozoic age on the evidence of supposed *Glossopteris* in the Burrum shales. He also described briefly some of the seams then being worked at Howard and Torbanlea.

The Rev. J. E. Tenison-Woods (1883A) placed the Burrum Coal Seams below the Ipswich Coals and above the Burnett River Coals, assigning them to the Upper Lias.

In 1886 R. L. Jack concluded that the coal measures between the Kolan River near Bundaberg and Noosa belonged to one coalfield which he assigned tentatively to the Mesozoic, probably between the Ipswich and Bowen River coal measures.

W. H. Rands (1886A) traversed the Burrum, Cherwell, Isis and Gregory Rivers and inspected the mines then operating. He considered the coal beds to be of "Mesozoic Carbonaceous" age, and included in the coalfield the metamorphosed sediments south of Childers. In conformity with earlier opinions he regarded the Maryborough beds as younger than the coal measures.

R. L. Jack (1888) gave the name "Burrum Beds" to the coal measures.

During an inspection of the Tiaro district, W. H. Rands (1890) noticed that the coal measures there were intruded and disturbed in contrast to those in the Burrum district and also that the Tiaro coals were non-caking while the Burrum coals caked. He did not, however, separate the formations. The metamorphics near Agnes Vale were, in his report, placed between the Burrum and Gympie Beds, *i.e.* equivalent to the Permian. Rands also recorded granitic intrusions at Mt. Bopple.

Jack and Etheridge (1892) retained a pre-Ipswich age for the Coal Measures and a Cretaceous age for the Maryborough Beds. Their remarks were confined mainly to recapitulation of previous literature.

The greatest contributions to our knowledge of the geology of the Burrum Coalfield were made by B. Dunstan. He (1912A) correctly placed the Maryborough Beds below the Burrum Beds; and he estimated the thickness of the Maryborough Beds at 1,000 ft. In a later report (1912B) he gave a brief account of the geological structure of the area. The sediments underlying the Maryborough Beds which had earlier been included in the Burrum Beds were given the name Tiaro Formation. Dunstan placed the Burrum Coal Measures and the Maryborough Beds in the Rolling Downs "Series" and the Tiaro Formation as the equivalent of the Ipswich Coal Measures. He considered that the Maryborough Beds succeeded the Tiaro Formation unconformably because of the intruded and disturbed nature of the Tiaro coal measures in contrast to the undisturbed Burrum Beds. In two later papers (1918, 1919) he discussed the structure of the field and divided the Coal Measures into Upper and Lower Unproductive and Middle Productive Measures.

Richards (1913) added more detail to Dunstan's work, especially regarding the small islands in Hervey Bay.

A. B. Walkom (1918, 1919) on palaeontological evidence established the age of the Burrum Coal Measures as Lower Cretaceous. The plan and sections accompanying Dunstan's introductory geological notes to these papers gave his interpretation of the structure

and extent of the potentially productive beds. The thickness of the coal measures was estimated at 5,000 ft., with the productive seams grouped in the middle section of 500-700 ft. of strata.

Bryan and Massey (1926) sub-divided the Tiaro "Series" as defined by Dunstan into four formations ranging in age from Middle Triassic to Lower Cretaceous. The oldest three of these formations were correlated with the Ipswich, Bundamba and Walloon formations respectively.

Whitehouse (1926, 1930) equated the Maryborough Beds to the Roma "Series" and specifically with the Australiceratan Stage of that formation.

David (1932) equated the Maryborough Beds (600 ft.) to part of the Roma "Series".

STRATIGRAPHY

Stratigraphic Succession:

The pre-Cretaceous formations in the area have not been examined in detail by the writer. Reconnaissance surveys were made across the Triassic and Jurassic formations and across the metamorphosed sediments south of Childers.

Bryan and Massey (1926) examined the Mesozoic succession in the area south and west of the Burrum Coalfield. They listed a conformable sequence of four formations with a total thickness of 12,000 ft. passing upwards, apparently conformably, into the Maryborough Formation. The lowest of these formations, the Brooweena "Series" was correlated with the Ipswich Coal Measures (Middle Triassic). Its relationship to pre-Mesozoic formations was not known. The overlying Myrtle Creek "Series" was correlated with the Bundamba Sandstone; it was succeeded in turn by the Tiaro "Series" as the equivalent of the Walloon Coal Measures. David (1932) has suggested that the last named formation may have extended from Lower Jurassic to Lower Cretaceous. The youngest of the four formations, Graham's Creek "Series", was placed by David in the Lower Cretaceous, or possibly Upper Jurassic. Overlying the Graham's Creek "Series" with apparent evidence of conformity is the Maryborough "Series" followed by the Burrum Coal Measures.

In this report the sequence proposed by Bryan and Massey, as outlined above, has been followed with some amendment of the Graham's Creek and Maryborough "Series". The junction between these formations is here placed much lower than previously. This adjustment is based on the author's mapping of partly tuffaceous marine sediments which outcrop discontinuously from Tinana Creek to Stockyard Creek, north of Childers. This evidence is supported by results obtained in the drilling of Lucky Strike Drilling Company's No. 1 Well (Cherwell Creek) and No. 2 Well (Susan River).

The stratigraphic sequence is summarised in the following table:—

Period		Formation	Lithology	Thickness
				Ft.
Recent		Sand and Gravel	Quartz Sand and Gravel	70
Tertiary		Volcanics	Rhyolite, Trachyte, Basalt, and Tuffs	?
		Elliott Formation	Sandstone and Conglomerate—some shale	<150
		∧∧∧∧∧∧∧∧∧∧∧∧∧∧∧∧∧∧∧∧		
Cretaceous	U			
	L	Burrum Coal Measures	Sandstone and Shale with Coal Seams	5,500
		Maryborough Formation	Shale, Silstone and Sandstone (some tuffaceous)	6,000
Jurassic	U	Graham's Creek Formation	Tuffs, tuffaceous Sandstone and Shale	4,500
	M L	Tiaro Coal Measures	Shale and Sandstone with Coal Seams	4,000
Triassic	U	Myrtle Creek Sandstone	Siliceous Sandstone, minor Shale	1,700–2,000
	M L	Brooweena Formation	Shale, Sandstone and Conglomerate	?
		∧∧∧∧∧∧∧∧∧? ∧∧∧∧∧∧∧∧∧		
Permian		Gympie Group	Marine Sediments and Volcanics	?

Triassic:

THE BROOWEENA FORMATION:

This was originally named the Brooweena Series by Bryan and Massey (1926). The term "Series" is, however, inadmissible in this case and in the Geological Map of Queensland (Tweedale, *et. al.* 1953) the name has been altered to Brooweena Formation without further definition of the rock unit. The description given by Bryan and Massey is of shales, sandy shales, sandstones and conglomerates and the type area is the Gayndah Railway between Brooweena and Aramara. The relationship of this formation to the Permo-Carboniferous Gympie Group is still not clear. It is followed conformably by the Myrtle Creek Sandstone.

The metamorphosed sediments occupying a large part of the Aramara and Kullogum Forestry areas south of Childers are considered by the author to be part of the Brooweena Formation. W. H. Rands (1886A) described them as "chiefly micaceous slates and altered sandstones with, in places, quartzite and gneiss." In a later publication Rands (1890) wrote: "On the western boundary of the Burrum Coal Field near Agnes Vale, the coal measures pass down into a series of altered rocks, but there is there no evidence of unconformability as there is in the case of the Burrum and Gympie Beds." He placed the metamorphics in the Permian; that is, older than the coal measures and younger than the Gympie Beds.

L. C. Ball (1902) assigned these metamorphics doubtfully to the Gympie Beds. Reid (1931) placed them in the Triassic as did David (1932); in the latest Geological Map of Queensland they are shown as Triassic.

No representatives of this formation have been located by the writer immediately north of the granites and deep red soils of the Childers area. Similarly no representatives of the Myrtle Creek Sandstone or the Tiaro Coal Measures have as yet been observed by the writer in this area, although the Graham's Creek, Maryborough and Burrum Formations are represented. The most probable explanation of the absence of the older formations is that this was an area of non-deposition in the Triassic and Lower and Middle Jurassic.

In the Aramara and Kullogum Forestry Areas the Brooweena Formation has been affected by granitic intrusions of probably Upper Jurassic age. The metamorphic effects are, in general, not intense and the formation there comprises mainly altered sandstone, micaceous schist and slate. Dip is extremely variable. The formation is overlain in places by post-Cretaceous volcanics. On the Teebar Road, outcrops of the formation comprise close jointed fine sandstone and shale weathered grey-green or brown. Both sandstone and shale are micaceous and are non-calcareous at the crop. Dip is variable, reversals being present near Aramara and along the Gayndah Railway. Regional dip is to the north-east.

The age of the Brooweena Formation is not known accurately. It is the oldest of the Mesozoic formations in the area. Its junction with the underlying Permian sediments is probably unconformable.

Bryan and Massey regarded the formation as equivalent to the Ipswich Coal Measures. This correlation was based partly on lithology and partly on the presence of *Thinnfeldia*. No other recognisable plants were found by them in this formation.

The evidence suggests a Middle Triassic age for the Brooweena Formation.

THE MYRTLE CREEK SANDSTONE:

This formation was originally named the Myrtle Creek Series (Bryan and Massey, 1926) being described as "very massive siliceous sandstones showing marked current bedding." The type area is the Gayndah Railway between Hunter's Hut and Thinoomba. It overlies the Brooweena Formation conformably and is followed conformably by the Tiaro Coal Measures. The term "Series" is here inadmissible and the term "Sandstone" is submitted as a substitute. The thickness of the formation is estimated to be 1,700-2,000 ft. Exposures south of Childers and again on the new Forestry Road (from Maryborough) to the Kullogum Forestry Area lie to the east of the metamorphics discussed above but the junction is obscured by soil cover and Tertiary tuffs and lavas.

The formation was correlated by Bryan and Massey with the Bundamba Sandstone (Upper Triassic), but it may ascend into the Jurassic. No fossils have been collected from the Myrtle Creek Sandstone. In the Cabbage Tree Mountain area granite has intruded the formation.

The dominant rock type outcropping is the striking white siliceous sandstone described by Bryan and Massey. Interbedded with this sandstone are fine to medium non-calcareous sandstone and shale weathered greenish-brown. At Cloudy Creek white shale is interbedded with the sandstone.

Jurassic:

THE TIARO COAL MEASURES:

The Tiaro Formation (Dunstan, 1912), as defined originally, comprised a "series of shales, sandstones and coal seams" outcropping between Mungar and Gunalda. These beds were "disturbed by dykes of porphyry, felsite, dolerite and syenite." This definition corresponds fairly closely with that of the present restricted use of the Tiaro Coal Measures, but Dunstan appears to have included all the strata between the Gympie Beds and the Maryborough Formation (original definition) in the Tiaro Formation. Bryan and Massey (1926) re-defined the Tiaro Series to include only part of Dunstan's Tiaro Formation. As the term "Series" is not applicable, the formation was re-named Tiaro Coal Measures without further definition in the Geological Map of Queensland (1953). The town of Tiaro from which the formation name is derived is 22 miles by rail south of Maryborough. The description of the Tiaro Series given by Bryan and Massey is "soft, friable shales, often carbonaceous and sometimes containing coal seams, sandy shales, and soft, micaceous sandstone." The type area is the "Gayndah Railway between a point 1½ miles west of Thinoomba where it (Tiaro Coal Measures) conformably succeeds the Myrtle Creek series, to a point about one-half mile to the east of Yerra." This definition now applies to the Tiaro Coal Measures. The thickness of the formation is estimated at approximately 4,000 ft.

The formation has been disturbed by faulting and folding and in the neighbourhood of Mt. Bopple which is 5 miles south of Tiaro the coal seams are altered to graphite and anthracite by igneous intrusion. It

has been intruded by granite in the Cabbage Tree Mountain area. In other localities it has been intruded by porphyrite.

Bryan and Massey correlated the Tiaro Coal Measures with the Walloon Coal Measures (Middle Jurassic). Their correlation was based partly on lithology and partly on palaeobotanical evidence. Fossil plants were collected from three separate localities within the formation. An assemblage of five species including *Taeniopteris spatulata* (McClelland) and *Equisetites rotiferum* (Tenison-Woods) indicated a correlation with the Jurassic Walloon Coal Measures. David (1932) suggested that this formation continued into the Lower Cretaceous.

This formation outcrops poorly and consequently relatively few beds were examined. With the exception of the basal beds, these comprised green and brown shale and micaceous sandstone with some coaly shale and coal. In the lower part of the formation there are some thin beds of fine-grained quartz sandstone somewhat similar to those of the Myrtle Creek Sandstone.

THE GRAHAM'S CREEK FORMATION:

The name Graham's Creek Series was proposed by Bryan and Massey (1926) for "a very considerable thickness of tuffaceous sediments" comprising "trachytic and andesitic tuffs and tuffaceous sandstones" exposed in the banks of Graham's Creek and lying between the Tiaro Coal Measures and the Maryborough Formation. The term "Formation" has now been substituted for "Series" which is inadmissible. The upper part of this sequence which consists of partly tuffaceous marine sediments, is, however, considered by the author to be part of the Maryborough Formation and the thickness of the Graham's Creek Formation is now estimated at about 4,500 ft., comprising mostly tuffs and tuffaceous sandstone with subordinate shale.

The sections penetrated in the two oil wells drilled for the Lucky Strike Drilling Company in the Maryborough area showed, in both cases, over 700 ft. of shale between the base of the Maryborough Formation and the top of the tuff beds in the Graham's Creek Formation (C. W. Siller, 1955, 1956A). Stratigraphical logs of these two wells are published in the Report of the State Mining Engineer for the year 1955. The logs were compiled by T. Madden from information supplied by the Lucky Strike Drilling Company. No field evidence of this shale was found by the writer because of the complete absence of outcrops in the area where the shale would be expected.

Because of the absence of field evidence this shale has not been designated a separate formation. The tuffaceous beds are well exposed on the Maryborough-Teebar Road between two points located two miles and seven and a half miles respectively southwest of its junction with the Musket Flat Road.

This formation has been recognised by the writer at intervals from the type area to just south of Delan on the Wallaville Branch Railway. Tuffaceous and volcanic rocks between the Kolan River and Baffle Creek belong to this formation also. The formation disappears for some miles north of Delan due to large scale faulting which has brought the Maryborough Formation up against Palaeozoic metamorphic rocks.

In the south the Graham's Creek Formation is dominantly tuffaceous with interbedded shale and sandstone and with a thick sequence of shale at the top. Andesite and trachyte flows are common in the northern part of the outcrop area and near the top of the formation there is fluidal rhyolite. It seems certain that the top shale bed occurs only in the southern part of the area as the volcanics have been observed by the writer almost immediately below the marine beds in the northern part.

No direct evidence of the age of the formation has been found. Bryan and Massey regarded the Tiaro, Graham's Creek, and Maryborough Formations as a comformable sequence, but whether there were periods of non-deposition between the formations is not known. It is probable that there was little or no break between the Graham's Creek Formation and the Maryborough Formation which is also slightly tuffaceous in part. It is likely, therefore, that the Graham's Creek Formation does range into the Lower Cretaceous.

Cretaceous:

THE MARYBOROUGH FORMATION:

The name "Maryborough beds" was given to this formation in 1872 by R. Etheridge, Senr., who correctly placed it in the Cretaceous. The strata named by Etheridge comprised only the top 700 to 1,000 ft. of marine beds now included in the formation. The name "Maryborough Formation" was used in the Geological Map of Queensland (1953) where no definition was given.

The Maryborough Formation is here defined as the formation comprising shales, siltstones, and sandstones, some of which are tuffaceous, lying conformably between the Graham's Creek Formation below and the Burrum Coal Measures above. The thickness is estimated at approximately 6,000 feet. No complete section has been measured at the surface because of scarcity of outcrops in the middle part of the sequence. The most complete section of the Maryborough Formation examined by the writer is exposed along the road from Maryborough to Yengarie between the quarries at Baddow and the Yengarie Railway Station. In this area the upper half of the middle part of the formation does not outcrop.

The lower part of the formation, comprising tuffaceous siltstone and sandstone, in part silicified, with thin boulder beds at the base has been mapped by the writer at intervals from Tinana Creek in the south to Baffle Creek. Little is known of the middle part of the sequence from surface exposures. Brown

and green weathered sandstone and shale cropping out in Wongi Creek near its junction with Doóngul or Stony Creek and in Stony Creek just south of the Forestry Road crossing are stratigraphically below the fossiliferous marine beds recognised by Etheridge, Senr., Dunstan and others. These siltstones and sandstones contain fragmental plant remains and according to C. W. Siller (personal communication) marine fossils also. Assemblages of marine fossils with plant remains are not uncommon in the upper part of the formation. No fossils were found in tuffaceous sandstones cropping out on several low ridges south of the Wongi and Stony Creek outcrops. From a mile south-south-west of Oakhurst to Yengarie there are outcrops of fossiliferous fawn siltstone and sandstone. The majority of these exposures have been lateritised.

Beds of the Maryborough Formation exposed in Baddow Quarry.

In Kolbore Creek, green sandstone and shale crop out at intervals for half a mile upstream from the junction of two disused roads in the old station property. No fossils were found in these strata which are in a similar stratigraphic position to the outcrops seen in Stony Creek but below those in Wongi Creek. Between the Bruce Highway and Native Dog Creek, isolated exposures of brown weathered sandstone and shale crop out along a disused timber track. Fawn siltstone containing marine fossils which crops out in the same locality is lower in the succession. Along the south bank of the Isis River downstream from Native Dog Creek beds of fawn siltstone similar lithologically to the fossiliferous marine beds north of Childers are placed near the middle of the formation. Thin pebble beds in which the rounded pebbles and boulders are mostly of volcanic rocks are exposed north-west of the Isis

River in the basal part of the marine sequence. The upper part of the Maryborough Formation comprises all the strata previously included in the Maryborough Beds. These were described by Dunstan (1912) and Richards (1913). Dunstan estimated the thickness of the marine rocks exposed on Woody Island as follows:—

Marine rocks	. . . .	500 ft.
Freshwater strata	. . . .	50 ft.
Marine beds	. . . .	200 ft.*

* Total thickness not known as not fully exposed.

Richards described the marine sediments exposed on woody, Picnic, Duck and Little Woody Islands in Hervey Bay as sandstones, calcareous sandstones, and shales, some of which are silicified.

Approximately 600 ft. of silicified sandstone and siltstone comprising the upper part of the Maryborough Formation are exposed in the south bank of the Isis River just south of the Bruce Highway; no interbedded freshwater strata were observed. Further north near the Goodwood-Cordalba road crossing of Stockyard Creek these strata comprise soft, light grey and white tuffaceous siltstone and sandstone.

The records of the two wells drilled for the Lucky Strike Drilling Company indicate that the thickness of the Maryborough Formation (No. 1 Well) is not less than 5,145 ft. and almost certainly as great as 6,080 feet. The formation comprised shale and sandstone in the upper part and predominantly shale with minor developments of sandstone and dense limestone in the lower part. (C. W. Siller, 1955, 1956B).

Basal beds of the Maryborough Formation.
These are exposed in a road cutting on the Bruce Highway, 3½ miles west of the Isis River.

The Maryborough Formation was correlated with the Australiceratan Stage of the Roma Formation (lower Aptian) by Whitehouse (1926B) who recognised four stages of the Aptian of which the Australiceratan Stage was the second lowest. This stage he identified by *Australiceras, Peratobelus australis* (Phillips), *Maccoyella barklyi* (Moore) and *Maccoyella corbiensis* (Moore) with only primary and secondary ribs. All of these he identified in the "Maryborough Beds" which comprise the upper 700-1,000 feet of the Maryborough Formation as it is now defined. No palaeontological work has yet been done on the underlying 5,000 feet of sediments in the formation and the earlier limit of its time range is therefore not known.

The Burrum Coal Measures:

Conformably overlying the Maryborough Formation are the Burrum Coal Measures. The name Burrum Beds was applied to the coal measures of the Burrum and Tiaro districts by Jack (1888). Dunstan (1912A) recognised the true relationship between the Maryborough Formation and the coal measures above and below; to those overlying the Maryborough Formation he gave the name Burrum Coal Measures. This formation comprises approximately 5,500 feet of freshwater sediments including greywackes and siltstones (some of which are slightly calcareous) shale, carbonaceous shale and coal seams. The commonest strata are light green sandstone and siltstone, white sandstone and interbedded light grey sandstone and dark grey siltstone. There is some thickening of the lower part of the formation in the western part of the area. Outcrops of the formation are scattered and no continuous section can be measured.

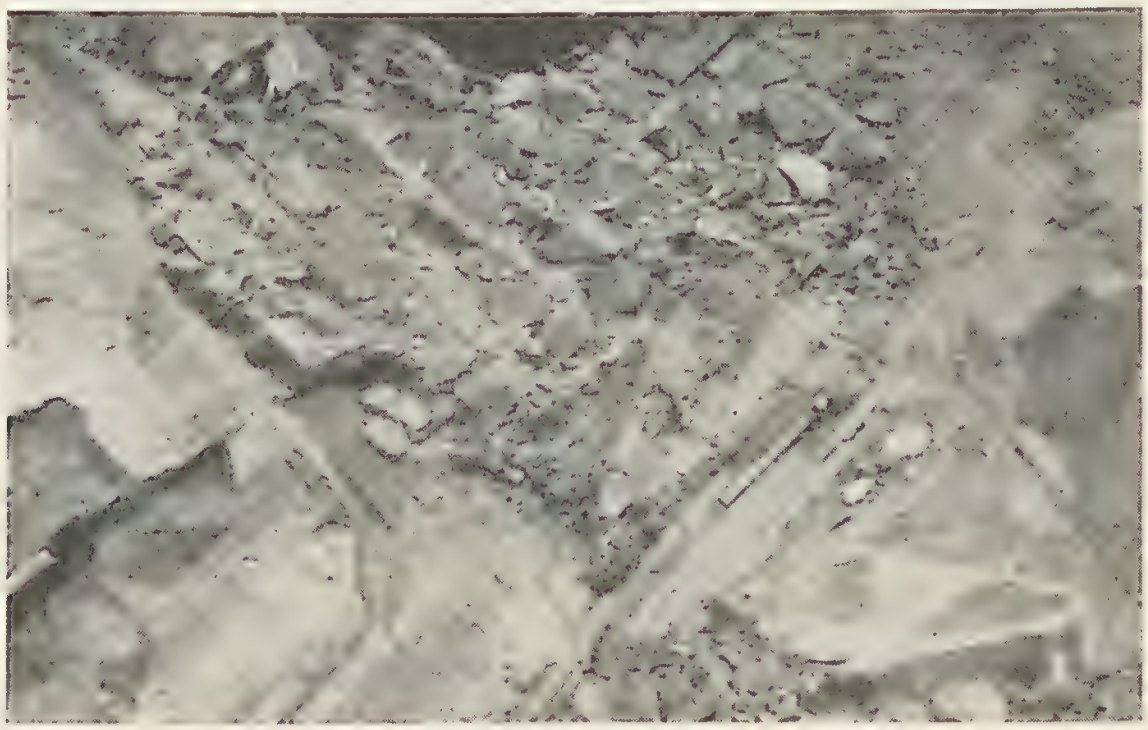
An angular unconformity separates the Burrum Coal Measures and the younger Elliott Formation.

The more important coal seams are grouped in about 1,600 feet of strata near the middle of the formation; and because of the grouping of the working

seams in this manner, Dunstan (1919) subdivided the Burrum Coal Measures into three sections comprising Lower and Upper Unproductive Measures and a Middle Productive Measures.

The formation outcrops poorly. The "Productive Measures" are known from the diamond drill cores and are described later, but representative successions for the lower and upper "Unproductive Measures" are unavailable. Because the younger Elliott Formation overlies much of the coal measures outcrops are restricted to creek and river beds. There are sufficient of these isolated outcrops of the lower and middle parts of the formation throughout the field for general structural interpretation. No outcrops of the upper "Unproductive Measures" were seen by the writer. In the south bank of the Isis River upstream from the Bruce Highway the basal part of the formation has recently been exposed by quarrying. About 400 ft. of strata are exposed there, comprising brown and light green sandstone and siltstone. The lowest coaly strata seen by the writer overlie these beds just south of the road bridge. The Lower Unproductive Measures are thicker in the northern and western parts of the area than in the southern and eastern parts and their maximum thickness probably exceeds 3,500 ft.

The sandstones of the Burrum Coal Measures are fine grained greywackes. The size of the larger grains ranges up to ·25 millimetre. The grains are angular and sorting is poor. Quartz is the most common mineral of the larger grains. There is some felspar and also some rock fragments. Fragments of carbonaceous material are common in some beds. The femic and heavy minerals are almost completely absent. In the very small heavy mineral fractions obtained by crushing and panning diamond drill cores, ilmenite, zircon, tourmaline, hornblende and rutile occur. Near the bottom of the formation these grains are tightly packed in a finer grained matrix of silt and smaller sized grains. In the higher beds examined there is a greater proportion of matrix. In the weathered rock limonite occurs as a stain throughout. Chlorite is present in variable quantity in the matrix.



Burrum Coal Measures.
Lower Unproductive Measures exposed in the east bank of the Isis River ¼ mile upstream from the Bruce Highway.

There are some coal seams in Dunstan's "Unproductive Measures," but the majority are known only from creek exposures and have not been prospected. The majority of these seams were mapped by Rands (1886) and are shown on Figure 1. There are several which do reach workable thickness, however, and some of these were worked in the Two-Mile, Wilston and Burnbank Collieries near Torbanlea. Another small seam was worked in the Burgowan Nos. 1, 2 and 3 Collieries north-east of Torbanlea. The upper limit of the "Productive Measures" has been extended to include these seams. Another small seam worked for a few years at Burrum East Colliery is higher in the succession. The Burrum East Colliery was located approximately half a mile in a north-easterly direction from the Burrum Railway Station. The seam worked was small, ranging up to 3 ft. 3 in. in thickness, but over the greater part of the colliery it was free of bands. On the north-western side of the colliery a brown shale band appeared near the middle of the seam. The shale gave way to sandstone which increased so much in thickness that development in this direction ceased. Bores ahead of these north-western levels failed to penetrate the seam which probably pinched out entirely in this direction. To the dip and to the south-east the seam thinned out gradually and the colliery was abandoned in 1936. The seam dipped to the north-north-east at grades of 1 in 8 to 1 in 12.

The only seam in the Lower "Unproductive Measures" to be proved workable so far is the seam drilled in the Rifle Range area, south-west of Howard.

Reserves of half a million tons of coal averaging 3 ft. in thickness are reported to be present in the drilled area (J. H. Reid, 1926).

The "Productive Measures" referred to in this report have the unnamed seam worked at Burnbank Colliery as the upper limit and the Glenesk Seam as the lower limit; they comprise approximately 1,600 ft. of strata. Dunstan placed his upper limit at the Bridge Seam and the lower limit at the Watson Seam, thus restricting the thickness of "Productive Measures" to 500 ft. of strata.

In the "Productive Measures" at least eight seams—possibly more—have been worked in various parts of the field. However, correlation of seams throughout the field still presents problems because of the lenticularity of all the strata, and consequently each locality will be discussed separately in the section devoted to the productive area of the field.

Because of the lenticularity of the sediments, including the coal seams, the interval between any two seams shows considerable range, even within the limited areas that have been drilled. The lenticularity of the coal seams is seen in coal thickness and in the thickness and lithology of the included stone bands. No seam has a constant sequence of included bands over more than a few square chains and seams are, in general, not recognisable from their sections alone. In addition, exposures are so few that detailed surface mapping of coal seams is impossible. The more important seams do, however, appear to be continuous throughout the field as coaly or carbonaceous sections, even though the workable areas are very limited in extent.

Because of these conditions it is impossible, at present, to establish other than tentative seam correlations between the various working areas of the field. The author is of the opinion, however, that with perhaps a few exceptions the same seams constitute the working groups in different localities.

Correlation based on microspore assemblages has been applied to one of the working areas—north-east of Torbanlea—where de Jersey (1951) has established a sequence of five seams actually being worked at that time. The seams worked in the abandoned collieries in that part of the field, with the exception of Burgowan Nos. 1, 2 and 3 and another small colliery, can also be correlated with de Jersey's sequence which is as follows:—

Quentin Seam—
Sandstone and shale
Portland No. 1 Seam—
Sandstone and shale
Portland No. 2 Seam—
Sandstone and shale
Ellangowan Seam—
Sandstone and shale
Jubilee Seam

The seam worked at Burgowan Nos. 1, 2 and 3 lies approximately 110 ft. stratigraphically above the Quentin Seam where the interval is known.

Abandoned collieries in other parts of the field were not included in the investigation because only dump material was available for sampling; as the majority of these pits worked more than one seam, specific seam samples were unobtainable. If drilling is extended to these areas and the previously worked seams are identified in the drill sections, microspore correlation may then be possible throughout the field.

The use of the names given to the seams where originally worked in the Torbanlea area and exposed in the banks of the Burrum River (Watson, Jewel, Burrum, Torbanlea and Bridge) was discontinued by de Jersey because of the confusion resulting from uncertain correlations in the past between worked seams and outcropping seams, the lack of proof that the same seams extend from one limb of the syncline to the other, and the difficulties attendant on obtaining uncontaminated, fresh samples from the seams in the original type area. The writer is in agreement with this; however, in descriptions of the old abandoned collieries in a later section of this report the old names have of necessity been retained.

The Burrum Coal Measures were originally thought to be continuous with the Tiaro Coal Measures, the whole being older than the Maryborough Formation. Estimates of age ranged from Permian to Trias-Jura. Dunstan (1912B) recognised that the Burrum Coal Measures were conformable on the Maryborough Formation and distinct from the Tiaro Coal Measures. He placed the Burrum Coal Measures in the Lower Cretaceous (in the upper part of the Rolling Downs Formation). Walkom compared the Burrum assemblage with known Lower Cretaceous assemblages throughout the world and concluded that it was a typical Lower Cretaceous (pre-Aptian) flora. He also showed that it was distinct from earlier Australian floras. The percentage of Coniferales had increased to 25 per cent. Cycadophyta (22 per cent.) and Filicales (44 per cent.) were well represented. Equisetales (3 per cent.) were becoming scarce and the number of Ginkgoales (6 per cent.) had also decreased.

Walkom's determination of the age of the Burrum Coal Measures as pre-Aptian is at variance with Whitehouse's determination of the age of the upper part of the underlying Maryborough Formation as Lower Aptian. However, the apparent absence of Angiosperms from the Burrum Flora suggests that deposition of this formation did not extend into the Upper Cretaceous.

Tertiary:

THE ELLIOTT FORMATION:

The name Elliott Formation was given by W. F. Ridley (1957) to "a formation of quasihorizontal fresh water sediments 20-40 ft. thick . . . . in the Maryborough Bundaberg area." In his description Ridley

says that the formation is thickest in its northern part —60 to 70 ft. near Bundaberg—thinning out to the south; the sediments comprise mainly sandstones and conglomerates, of which the latter form "irregular lenses within the sandstones and appear to be confined to the base of the formation at the northern end." The sandstones are "massive, fine to medium grained with some grits and irregular strings of pebbles. Flecks of white kaolin are common in the groundmass." In his definition, Ridley says "a complete type section in any one locality is not to be found but most of the formation's characteristics may be seen along the banks of the Elliott River."

This formation has previously been referred to informally by C. W. Siller (1955) in an unpublished report. He described typical rocks of the formation as "white felspathic sandstones with minor red and grey clayey shales." He also observed that the formation increased in thickness towards the north, stating that it comprised 127 ft. of sediments beneath the basalt at the Sloping Hummock near Bundaberg.

S. R. L. Shepherd (1946) in an unpublished report described similar sandstones with a thickness of up to 40 ft. forming the aquifers north-west of Childers.

Earlier brief references to this formation were made by Gregory (1879A), Rands (1886A) and Ball (1902). These references are, however, confusing as these authors failed to distinguish between the sandstones of the Elliott Formation and lateritised Burrum Coal Measures.

Pebbly sandstone of the Elliott Formation.
This outcrop is in the east bank of the Isis River ¼ mile downstream from the Bruce Highway.

The Elliott Formation overlies Cretaceous, Jurassic and possibly older formations unconformably. Ridley has found it resting directly on weathered granite near Childers. It was deposited on an almost flat erosion surface and has not been affected by any folding movements. In many localities the formation has been lateritised.

The age of the formation is not known accurately. Ridley regarded it tentatively as "post late Oligocene and pre-Miocene" on the grounds that it post-dated the orogeny which folded the Burrum Coal Measures probably in the upper Cretaceous, and also another orogeny which Bryan and Jones postulate in the late Oligocene and that it preceded the period of lateritisation (probably Miocene). Because the postulated Oligocene disturbance is not known definitely to have affected the Maryborough area, the author is of the opinion that the age of the Elliott Formation cannot be fixed more precisely than early Tertiary. It is certain, however, that, a long interval of erosion intervened between the Upper Cretaceous orogeny and the deposition of the Elliott Formation because of the flatness of the surface on which the latter formation was deposited. As there are insufficient surface exposures in this area for geological mapping of this formation it is not shown on the accompanying geological map.

Tertiary Volcanics:

Tertiary Volcanics in the Childers, Kullogum, Dundowran and Mungar areas comprise basalt, trachyte, rhyolite and trachytic and rhyolitic tuffs. The trachytes and tuffs and some of the rhyolites are found to the south and south-east of Childers in or near the Kullogum Forestry Area. Basalt is found north of Childers. There is also a small area of basalt near Dundowran. Only reconnaissance traverses were made in these areas and these volcanics have not been mapped. Some of the basalt and the tuffs, rhyolite and trachyte south of Childers do not appear to have been lateritised.

Recent:

Beds of unconsolidated sand and gravel up to 70 ft. thick directly overlie the Burrum Coal Measures in some places. Known occurrences are restricted to narrow areas on both sides of the Burrum River at the northern end of the Burrum Syncline, where they were passed through in boreholes prospecting for coal. They consist mainly of medium to coarse quartz sand.

IGNEOUS ACTIVITY

Mesozoic:

The Brooweena, Myrtle Creek and Tiaro Formations have been affected by granitic intrusions in the Cabbage Tree Mountain, Aramara and Kullogum Forestry areas. Intrusion of the Tiaro Coal Measures by dykes was observed by Rands (1890), Dunstan (1913) and Bryan and Massey (1926). Both Rands and Dunstan observed granitic intrusions at Mount Bopple which they thought had affected the Tiaro Coal Measures altering some of the coal to graphite. The Noosa intrusions are believed to be of the same age. No intrusion of the Graham's Creek Formation was observed by any of these geologists and the field maps of L. R. Blake also indicate that this formation is free of intrusion as do the observations of the present writer.

This evidence indicates only that intrusion occurred after the deposition of the Tiaro Coal Measures. The evidence is inconclusive concerning the upper time limit.

The geographical distribution of the intrusives suggests that they occurred shortly after the deposition of the Tiaro Coal Measures and this is supported by the absence of any intrusives in the two deep oil wells which penetrated nearly to the base of the Graham's Creek Formation on the Cherwell and Susan River Anticlines. However, the greater part of the Mesozoic sediments in this area is probably covered by the Pacific Ocean and the true distribution of the igneous rocks is difficult to determine.

On the other hand as noted also by Bryan and Massey the attitude of some of the beds in the neighbourhood of Cabbage Tree Mountain in particular suggests that the intrusion may have post-dated the folding.

The weight of available evidence favours the the interpretation that the intrusions preceded the deposition of the Graham's Creek Formation and therefore occurred in the late Jurassic.

Bryan and Jones (1926) regarded the granitic and porphyritic intrusions as late Jurassic or early Cretaceous. Jones (1948A) placed the granites in the Upper Cretaceous, relating them to the earth movement which folded the Burrum Coal Measures.

Volcanic activity commenced late in the Jurassic and continued intermittently during the Lower Cretaceous till the Aptian.

Tertiary:

Volcanic activity was renewed briefly after the deposition of the Elliott Formation but before the period of lateritisation with the extrusion of basalt and ejection of tuffs. The later volcanics (rhyolite, trachyte, basalt and tuffs) appear to have been extruded and ejected after the period of lateritisation.

STRUCTURAL GEOLOGY

The earliest sediments deposited in the Maryborough sedimentary area distinct from the Tasman Geosyncline are of Permian age. There is one known unconformity in the post-Permian record between the Burrum Coal Measures and the Elliott Formation—and the Permian-Triassic relationship also is probably uncomformable. Disconformities are probably present in the Triassic and Jurassic formations.

The Mesozoic sediments deposited in this area have been folded into a simple series of parallel north-north-west trending anticlines and synclines. The dips in these structures are, in general, moderate. However, some as steep as 80 degrees (probably due in part to faulting) have been observed over a small area in the northern part of Woody Island (Richards, 1913) and dips in the Maryborough Formation ranging up to 60 degrees have been observed by the author along the Isis River upstream from the Bruce Highway. The apparent absence of the Graham's Creek Formation just north of Bullyard is thought to be due to overthrusting.

Folding occurred after the Burrum Coal Measures were deposited and prior to the deposition of the Elliott Formation and subsequent lateritisation of it and all the older formations. This places the age of folding within the limits post-lower Cretaceous and Pre-Miocene. Since a long erosion interval and the deposition of the Elliott Formation both post-dated the orogeny and preceded the lateritisation period, the folding probably occurred near the earlier time limit, that is, early in the Upper Cretaceous. Richards (1913) suggested that the folding occurred at the latter end of the Lower Cretaceous. Jones (1948A) placed the orogeny in the Upper Cretaceous.

Because the Burrum Coal Measures are usually concealed by soil, laterite, or Tertiary formations, the majority of faults are known only from the colliery workings. Exceptions are the Point Vernon Fault which is a reverse fault of unknown displacement and the Isis Fault which is a normal fault mapped by C. W. Siller from outcrops in the Isis River. The displacement due to the Isis Fault probably exceeds 100 ft.

Another major fault which has been traced by the writer and C. W. Siller for several miles north-west of Bullyard is thought to be responsible for the absence of the outcrop of the Graham's Creek Formation in that area where the Maryborough Formation is underlain by Palaeozoic metamorphics.

The majority of these faults have been poorly recorded, the only information now available in many cases being the trend of the fault. Other records give the throw but do not indicate whether the fault is normal or reverse. The information available, however, indicates that with only one or two exceptions, all the faults in this field fall into two clearly defined groups striking almost at right angles to each other. One of these groups trends N. 320 degrees-335 degrees E., almost parallel to the fold and the faults in this group, where known by the writer, are reverse faults. The other group trend N. 25 degrees-50 degrees E. and at least some of these are known to be normal faults. No regular pattern of direction of displacement is discernible.

Many of the faults encountered displace the strata only a few feet. In the larger ones, throws of the order of 30 to 60 ft. have been recorded and one fault in the Torbanlea Colliery was reported to have a throw of 110 ft. in the northern part which decreased rapidly, however, to only a few feet in the southern (shallow) part of the colliery.

Economically the most important structure in this area at the present time is the Burrum Syncline, for it is there that the productive coal seams have been preserved. The same horizons have probably been preserved in other synclines in the field but for several reasons no systematic attempt has yet been made to exploit these other areas. This is largely due to the fact that the Burrum Syncline is centrally situated and sufficient coal has been found there to supply the demand up to the present time. In consequence there has been little or no incentive for exploration of other areas. Whether the seams in these areas are similar in thickness and quality to those in the Burrum Syncline remains to be proved as it is possible that conditions slightly less favourable for coal formation may have existed there during the Lower Cretaceous.

The Burrum Syncline is an almost symmetrical syncline bounded on the north-east by the Susan Anticline and partly bounded by the Cherwell Anticline to the south-west. Generalised axial trend is N. 130 degrees E. and maximum flank dips are of the order of 25 degrees–30 degrees.

The Cherwell Anticline is a fairly symmetrical closed anticline with flank dips of the order of 10 degrees. This structure extends from just north of Stockyard Creek to a short distance south of the Cherwell River. Axial trend is approximately N. 130 degrees E. It was first mapped by Rands (1886) but was not named till 1953 when it was referred to by R. Kamon in an unpublished company report as the "Cherwell Creek Anticline." The L.S.D. No. 1 Cherwell Well was located on this structure. It was abandoned as a dry well in the Graham's Creek Formation.

To the south-west of the Cherwell Anticline is the Pig Creek Syncline. This is an asymetrical syncline with dips on the south-western flank ranging up to 60 degrees. It is almost certain that at least some workable seams of coal have been preserved in this structure.

On the north-eastern side of the Burrum Syncline is the Susan River Anticline (Kamon) which was mapped by Dunstan (1912B). This is a fairly symmetrical structure which plunges to the north-north-west. Flank dips are generally of the order of 20 degrees but some as steep as 40 degrees occur. On the north-eastern flank some beds are stepped progressively to the west in a manner suggestive of cross-faulting but there is no other evidence of such faulting and the writer is of the opinion that this stepping to the west is due to folding. The Maryborough Formation is exposed in the core of this anticline and it was here that the L.S.D. No. 2 Susan Well was drilled. This well was also abandoned as a dry hole near the base of the Graham's Creek Formation.

To the east the Susan River Anticline is succeeded by another syncline and then by the Woody Island Anticline (Siller). Little is known of these structures as only a few dips can be measured in the strata outcropping on islands in Hervey Bay. These structures were described by Richards (1913).

GEOLOGICAL HISTORY

The sediments now exposed in the Maryborough area are an incomplete record of their former extent as the eastern part is covered by the Pacific Ocean. A few of the coastal islands are formed of Cretaceous sediments and have assisted the structure mapping; they do not, however, assist in defining the eastern limit of deposition; nor do they indicate whether a now submerged land mass bordered the depositional area on the eastern side during the Mesozoic.

Deposition in this area as an area of sedimentation distinct from the Tasman Geosyncline began in the Permian under marine conditions. During the Mesozoic Era fresh-water conditions prevailed except for part of the lower Cretaceous when the Maryborough Formation was deposited. The earlier formations were laid down under shelf conditions but the Maryborough Formation and the Burrum Coal Measures suggest geosynclinal conditions.

Granitic intrusions occurred, probably in the late Jurassic. Volcanic activity commenced in the late Jurassic with the ejection of tuffs and the extrusion of andesite, trachyte and some rhyolite. The Maryborough Formation is slightly tuffaceous in part and this activity probably continued, therefore, into the Lower Cretaceous, accompanying the change from unstable shelf to geosynclinal sedimentation.

During the Upper Cretaceous these sediments were folded. After this orogeny there was a long interval of erosion before the deposition of the fresh-water Elliott Formation and the extrusion of basalt and ejection of tuffs. The whole of this sequence was then subjected to a period of severe lateritisation, probably during the Miocene.

Subsequently widespread volcanic activity resulted in the extrusion of younger volcanics comprising rhyolite, trachyte, and basalt and rhyolitic and trachytic tuffs. Since then, due to a small emergence, many of the streams have cut through the thin Elliott Formation, re-exposing the Burrum Coal Measures in their beds.

THE PRODUCTIVE SECTION OF THE BURRUM COAL MEASURES

General:

The full productive section of the Burrum Coal Measures comprises approximately 1,600 feet of strata near the middle of the formation. The seams being worked at the present time are restricted to an even smaller part of the coal measures (approximately 500 ft.). The productive beds have been eroded from a large part of the outcrop area of the coal measures and are restricted to some synclinal areas where they crop out on the flanks; of these synclines, only one—the Burrum Syncline—has been systematically prospected and hence all the collieries are located on this structure.

Geological mapping suggests that the productive section of the coal measures probably underlies part of the area north-west of Howard towards Bundaberg. The geological structure of this area is, however, incompletely known and to the present time no definite correlation of any group of coal seams with those in the worked area is possible. Exploration of this area is desirable, even though mapping of the Burrum Coal Measures would be hampered by the Elliott Formation which almost completely mantles them north of Howard.

Although the seams which have been worked occur at intervals throughout 1,600 ft. of strata, those being worked at the present time are all in the middle part of this succession. The seams in the upper and lower parts of the "Productive Measures" do not reach the same maximum thickness and are not so persistent laterally as those in the middle part. As a result, prospecting has so far been restricted almost entirely to the middle part of the "Productive Measures." Significant differences in the proportions of shale and sandstone in the middle part compared with the proportions in the lower and upper parts are also apparent. In the middle part shale and sandstone are in approximately equal amounts whereas in the upper and lower parts there is only one fifth as much shale as sandstone. The upper and lower parts are gradational to the "Unproductive Measures" of the formation.

Close similarity of the shale-sandstone ratios of the middle part of the "Productive Measures" in separate parts of the field and also in the type of sediments deposited in these areas indicates that the depositional environment was reasonably uniform over most of the present working area while these sediments were being deposited. Consequently local thickening of the coal seams in the axial part of the Burrum Syncline as well as in the present outcrop area is to be expected.

The "Productive Measures" like the rest of the Burrum Coal Measures, outcrop poorly and the only reliable guide to their composition is the core from the drilled areas. The whole of the middle part has been drilled in four separate areas whereas all of the upper part has been drilled in only one area and in only one area has a significant portion of the lower part been drilled.

The dominant lithology of the cored section of the lower part of the "Productive Measures" is a dirty white sandstone which has a slightly mottled appearance due to the presence of small patches of chlorite. Towards the top this sandstone is interbedded with grey siltstone, which, in some places, contains fragmental plant remains. Iron carbonate in the siltstone causes it to weather brown on exposure. Shale, which is in minor amount, is grey to black. The darker coloured shales usually contain thin lenticles of vitrain, generally less than 5 mm. in thickness, and in many places they grade into coaly shale. The dark brown, very fine grained carbonaceous shales which are common in many Queensland coalfields rarely occur at Burrum. Approximately 230 ft. below the Jubilee Seam in Borehole No. N.S. 17 is a coal seam comprising 2 ft. top coal, 4 in. shale, 5 in. inferior coal, 4 in. shale, and 2 in. bottom coal. This is near the horizon of the Hartley Seam, but an exact correlation is not suggested.

The sandstones are best described as greywackes (Pettijohn, 1949). In general they comprise grains of quartz, felspar, rock fragments and other minor constituents set in a fine grained matrix of quartz and felspar with small amounts of chlorite and mica. Thus the matrix differs in some degree from the typical matrix described by Pettijohn.

These greywackes are dirty white to light green in colour, the green chlorite often giving a slightly mottled effect to the hand specimen. The matrix forms 30 per cent. to 60 per cent. of the rock. This matrix is very fine grained and consists of quartz with minor amounts of felspar, chlorite and mica. In some places there is a small amount of carbonate cement. The larger detrital grains are quartz (up to 65 per cent.), felspar (up to 30 per cent.), and rock fragments (up to 15 per cent.). Other minerals are rare. Most of the rock fragments are of very fine-grained volcanic rocks. A few are of shale or slate. The grains are angular and sorting is poor. The grain size of the cored sandstones below the Jubilee Seam is small, ranging from 0·1 mm. to 0·16 mm. No regular trend in grain size was observed.

The laminated rock resulting from the rhythmical succession of sandstone and siltstone bands is common. This regular succession in which individual bands range down to less than a millimetre in thickness is probably due to seasonal variation. Evidence is seen in many places of contemporaneous slumping and sliding. Micro-faulting and clastic dykes are common.

The middle part of the "Productive Measures" contains all the seams now being worked. These are described in detail in a later section of the report. By contrast with the underlying strata, the proportion of shale in these beds approximates to the proportion of sandstone. The shale is light grey to black in colour, contains coal lenticles and grades in some places to coaly shale.

In most respects the siltstones are finer-grained versions of the greywackes. However, the thin layers interbedded with the greywackes are, in most instances, dark grey to brown in colour and weather brown on exposure. Limonite occurs as a stain through the rock. Magnetite and secondary hematite are also present. Of the larger grains quartz is the most abundant mineral followed by felspar. The grains are angular. Plant fragments are common. In some of the light grey massive siltstone not interbedded with the greywacke flakes of mica are common.

The sandstones of the middle part of the "Productive Measures" are also of the greywacke type. In colour they range from dark greyish green to dirty white. As a general rule the grey-green representatives occur only in the lower and middle parts of this sequence but no absolute relationship of colour to depth occurs as the dirty white sandstones occur throughout the sequence. The greater part of the sandstone occurs interbedded with dark grey to brown siltstone in the same manner as described above.

The matrix again forms a large proportion of the rock. Of the larger grains quartz constitutes up to 70 per cent., felspar up to 35 per cent. and rock fragments up to 15 per cent. In restricted sections coal fragments are numerous. Femic minerals are virtually absent, only rare flakes of biotite being seen. Iron carbonate bands and nodules are common. Grain size is again small, ranging up to 0·16 mm. There is no apparent trend in grain-size, either laterally or vertically. Grains are angular and sorting is poor. The green colour is caused by chlorite in the matrix which is dominantly of quartz and felspar. There is a small amount of carbonate cement in some beds.

The complete succession of the upper part of the "Productive Measures" is known only in the P.D.T.S. No. 1 Area where sandstone forms nearly 70 per cent. of the sequence and siltstone nearly 20 per cent. Of the sandstone, approximately 65 per cent. is white and massive, 20 per cent. is light grey or green and the remainder is white sandstone interbedded with dark grey or brown siltstone. In the Globe Area where the lower half of this sequence was drilled the proportions of sandstone, siltstone and shale are almost identical with those in the P.D.T.S. No. 1 Area. Over 70 per cent. of the sandstone is white and the laminated and grey-green sandstones are in approximately equal amount. The matrix forms a large part of the rock and there is again only a very small amount of carbonate cement. Grain size ranges up to 0·25 mm. and averages about 0·16 mm. The grains are angular. Sorting is poor. The more common grains are quartz (about 55 per cent.), felspar (up to 40 per cent.) and rock fragments (up to 40 per cent.). Coal fragments are common in some sections. The femic minerals are again virtually absent.

The area of the potentially workable part of the Burrum Syncline is approximately 50 square miles. Prospecting of the whole of this area is not yet complete. Partly because of this and partly because of the lenticular nature of workable areas of coal the collieries are located in four distinct groups, two of which are on the south-western limb of the syncline and two are on the north-eastern limb. The two groups on the south-western limb are centred about the towns of Torbanlea and Howard respectively. With the exception of Burgowan No. 11, north of Howard, all of the collieries in these two areas have been abandoned. One of the groups on the north-eastern limb is located approximately 3 miles north-east of Torbanlea. It comprises 2 working collieries and a number of abandoned ones. The fourth group which consists of two working collieries is located between Colton and Takura just south of the Pialba-Urangan branch railway.

The seams of coal were first discovered and named at the outcrops in the banks of the Burrum River which forms the boundary between the Howard and Torbanlea areas. The earliest pits were located in or near the banks of the river and identification of the seams presented few problems; but correlation became more difficult as mining activities moved further from the river and even within these two areas there was some confusion regarding identity of seams. When working areas were established on the other limb of the syncline and seams could not be traced along the crop from the original areas, correlation became even more difficult although it was still attempted by the colliery managers. Because the older collieries are now inaccessible and the crops in the river banks have been obliterated, the methods of correlation based on spore assemblages used by de Jersey (1951) for determining the sequence of working seams in the area north-east of Torbanlea cannot be applied to the Torbanlea and Howard areas, until drill-hole samples are obtained which can definitely be correlated with the worked seams, or further new collieries are developed in these areas; for this reason, de Jersey has given new names to the seams in the area investigated without attempting to relate them to the originally named succession. The writer has attempted to relate to de Jersey's sequence the seams drilled in the Globe-Churchill area in the southern part of the field by comparison of stratigraphic columns, but such correlations must be regarded as tentative because (1) individual shale and sandstone beds have been shown to be very lenticular; (2) it has not been proved that any or all of the main seams extend across the syncline as continuous seams; and (3) it has not been proved that the seams in any one area are identical with the seams in other working areas and do not, in fact, comprise interfingering groups.

In the collieries, deterioration of the seams is usually due to decreased coal thickness frequently accompanied by rapid thickening of stone bands and appearance of additional lenticular bands of stone. Seldom is seam deterioration due to deterioration in the quality of coal. In some areas, lenticular beds of finely interbedded carbonaceous shale and coal appear in the seam, e.g. at Rankin Colliery. As one result of these characteristics there are no typical sections of any of the seams.

There is a widespread belief in the Burrum Field that the seams do not "live" below a vertical depth of 500 ft. This belief is due to the fact that in the past, only those lenses of coal, which are actually of workable thickness at the surface, have been prospected and opened up and these lenses normally deteriorate at a comparatively shallow depth, just as they deteriorate laterally. Diamond drilling has, however, proved one workable area extending well below the vertical depth of 500 ft. although it is not workable at the crop; and it is expected that other such areas will be proved by this method. At the present time, however, drilling of such areas is not desirable as they are economically unworkable under present conditions unless they are easily accessible from other workings.

The coal, which consists mainly of bright coal with a few thin bands of dull coal, is of high volatile A bituminous rank (A.S.T.M. classification). It has a comparatively low sulphur content, averaging approximately 0·6 per cent. and an average ash content of approximately 10 per cent. It is medium to strongly coking with a high swelling index. Ash fusion temperature tends to be low (1,100-1,400 degrees C.).

In thickness the seams rarely exceed 6 ft. although in the past, sections over 8 ft. thick were worked in some collieries. At the present time the working seams range from less than 3 ft. to a little over 5 ft.

Nowhere within the working area of the coalfield has any evidence of igneous intrusion been found.

The Torbanlea Area:

General.—This area lying on the south-western flank of the Burrum Syncline includes the east bank of the Burrum River where the seams were first discovered and where Rands (1886A) measured the sections given in the first comprehensive report on the field (see figure 2A). The following succession of strata, which was compiled from the outcrops in the river banks between the railway bridge and the old road crossing about 1 mile upstream, is taken from that report:

Shale and sandstone
2 ft. 7 in. coal
5 ft. 0 in. carb. shale } Bridge Seam
3 ft. 0 in. coal
220 ft. chiefly shale, including 2 thin coal seams
2 ft. 0 in. coal (Lapham or Torbanlea Seam)
35 ft. shale
3 ft. 7 in. coal (Burrum Seam)
150 ft. shale with thin beds of sandstone and one thin coal seam (? Jewel Seam)
4 ft. 0 in. coal (Watson's Seam)
225 ft. shale and sandstone
1 ft. 6 in. coal
27 ft. sandstone and shale
2 ft. 6 in. coal
14 ft. sandstone
4 ft. 2 in. coal (North Hartley Seam)
200 ft. (about) sandstone with some thin seams
1 ft. 8 in. coal (Glenesk Seam)
Sandstone

Dips recorded are 12 degrees to 13 degrees in a direction N. 37 degrees-40 degrees E.

With the exception of the early drives from the banks of the river and Walsh's Shaft which intersected the Burrum Seam at a reported depth of 40 ft., the collieries in this area can be divided into three distinct groups, viz., Riverbank Collieries, Torbanlea Collieries (including Two-Mile) and the Wilston and Burnbank Collieries.

The Riverbank Collieries: In 1892 the first shaft at Riverbank was sunk to the Burrum Seam which it intersected at a depth of 220 ft. This seam was worked till 1904 when operations were transferred to the Watson Seam. Ball (1902) recorded that the Burrum Seam averaged 3 ft. 6 in. of clean coal in the shaft, ranging up to 4 ft. 6 in. in some parts of the colliery. A shale band which appeared near the middle of the seam a few chains to the dip of the shaft increased in thickness further to the dip and also along the strike in both directions. Decrease in coal thickness accompanied increase in thickness of the shale band; further, the top coal was of poor quality in some places where it contained nodular iron carbonate. The average grade of the seam was approximately 1 in 4½ in a direction N. 60 degrees E. The Burrum Seam was overlain at an interval of 3-6 ft. by a seam of inferior coal slightly less than 3 ft. thick and at an interval of 35 ft. by the Torbanlea Seam which there comprised two bands of coal, too thin to be worked.

Fryar (1900) gave the interval between the Burrum and Torbanlea Seams in the shaft as 7 ft. but it appears likely that this discrepancy is due to a wrong correlation by him of the small seam of impure coal just above the Burrum Seam.

The sections shown on the colliery plans give the maximum thickness of the middle shale band as 3 ft. 8 in. at the face of the bottom (No. 2) north-west level. Top coal measured 1 ft. 11 in., including 3 in. shale, and bottom coal 1 ft. 2 in. At the dip face the section was 10 in. top coal, 2 ft. 2 in. shale, and 1 ft. 2 in. bottom coal; and at the face of the No. 2 south-east level the section was 1 ft. top coal, 3 in. shale and 3 in. inferior coal.

The Burrum Seam was again worked at Riverbank from 1909 to 1912; an inclined tunnel 8 chains long was driven to the seam to work the area to the rise of the old workings. There is no record of the seam section in this area.

The Watson Shaft intersected the Watson Seam at a depth of 156 ft. The section of this seam penetrated in a borehole nearby is recorded on the mine plan as:

1 ft. 1 in. coal
1 ft. 0 in. stone band
1 ft. 2 in. coal
1 ft. 2 in. stone band
3 ft. 0 in. coal

The section in the main dip 4½ chains from the shaft is shown on the plan as:

1 ft. 2 in. coal
1 ft. 2 in. stone band
10 in. coal
1 ft. 9 in. stone band
1 ft. 2 in. coal
2 in. stone band
1 ft. 2 in. coal

This shaft was closed in 1909.

The Torbanlea Collieries.—This group, which was the largest in the Torbanlea area, operated intermittently under several owners from 1882 to 1929. The first owner was a Mr. J. Robertson who sold his interests to the Isis Investment Company in 1899; however, this company went into liquidation and the colliery reverted to its former owner. In 1902 it was acquired by the Mt. Perry Copper Mining Company, which failed in its efforts to dewater the mine. It was re-opened and operated by Mr. Robertson from 1904 to 1908. In 1915 the Torbanlea Colliery Syndicate purchased the Torbanlea Colliery and a small mine owned by the Churchett Torbanlea Coal Company. This syndicate which later became the Torbanlea Colliery, Limited, sold its interest in 1921 to the Woodley Syndicate which also purchased Churchett's Two-Mile Colliery. In 1926 the Burgowan Coal Company bought these properties and the Torbanlea Collieries were closed finally in 1929.

Descriptions of the early workings were given by Rands (1886A and 1886B) and Ball (1902). According to Rands the earliest workings were on the Burrum Seam which was passed through at a depth of 110 ft. in No. 1 Shaft. This seam 3 ft. 11 in. thick including 7 in. shale, was soon abandoned in favour of the Torbanlea Seam which was 25 ft. above it and was worked from a stone drive from the Burrum Seam. The Torbanlea Seam was 6 ft. 2 in. thick including a stone band 1 ft. 3 in. thick in the middle. The roof was slickensided black shale. The grade of the seam ranged from 1 in 4 near the crop to 1 in 6 in the deeper levels in a direction N. 53 degrees E. In 1886 No. 2 Shaft was sunk about 20 chains to the dip of No. 1 Shaft to a depth of 390 ft. 9 in. This passed through the Torbanlea and Burrum Seams at depths of approximately 344 ft. and 384 ft. respectively; and higher seams were passed through at 27 ft., 63 ft., 186 ft. (Bridge Seam), and 268 ft.

The records of this shaft given by Rands (1887) and Ball (1902) do not agree in several details. Of these discrepancies, the most important concerns the section of the Burrum Seam. Rands gives this section as follows:

Coal 1 ft. 0 in.
Band of shale 9 in.
Coal 5 in.
Fireclay 1 ft. 8 in.
Coal 2 ft. 0 in.

Ball's record shows the middle band of coal as 5 ft. instead of 5 in. as reported by Rands. However, the text of Ball's report does not support this record; and Rand's section is probably the correct one.

Both Rands and Ball give the following section for the Torbanlea Seam in No. 2 Shaft.

1 ft. 6 in. coal
7 ft. 0 in. shale
1 ft. 4 in. coal
4 ft. 4 in. shale
1 ft. 4 in. coal
10 in. band
8 in. coal
1 ft. 2 in. band
8 in. coal

Ball was unable to inspect the colliery because of water; however, the following information was supplied to him by Mr. Robertson and the manager.

The only work done on the Torbanlea Seam to the dip of No. 2 Shaft was an exploratory heading 7 chains long; but the seam sections in this heading are not recorded. On the north-western side of the colliery, approximately 30 chains from the shaft, a fault was encountered, having a downthrow to the north-west which increased from only a few feet in the higher levels, to 110 ft. at the dip.

A second fault was encountered on the downthrow side, striking at right-angles to the first, but this second fault was not penetrated due to lack of funds. The seam was thought to be thrown down again, as a borehole bored vertically upwards failed to locate the seam. The seam section in this part of the colliery was 4 ft. 6 in. top coal, 1 ft. 8 in. shale, and 1 ft. 6 in. bottom coal. To the north-west the seam thinned out gradually. An average seam section of the Torbanlea Seam throughout the colliery was said to be 3ft. top coal, shale band up to 2 ft. thick, and 1 ft. to 1 ft. 2 in. bottom coal. The Burrum, Jewel and Watson Seams were prospected from a stone drive near No. 2 Shaft. The Burrum Seam, approximately 40 ft. below the Torbanlea Seam had an average section of 1 ft. 8 in. top coal 1 ft. 6 in. shale, and 2 ft. bottom coal. Thick stone bands which developed in both top and bottom coal prohibited working to the dip of No. 2 shaft. The Jewel Seam, approximately 113 ft. below the Burrum

Seam, comprised 2 ft. 6 in. dirty coal, the top 8 inches being particularly inferior. Lying 3 to 6 ft. above this seam was the "Stranger" Seam, comprising about 2 ft. of coal. This interval of 113 ft. given by Ball is inconsistent with the length of the stone drive from the Burrum to the Jewel Seam and is about twice the calculated interval. The Watson Seam, about 95 ft. below the Jewel Seam was said to be unworkable; but no seam section was given.

No. 3 Shaft was located approximately 8 chains south-east of No. 1 Shaft. Ball recorded that this was sunk 220 ft. to the Watson Seam which was said to be unworkable in the shaft. Borehole sections in that area gave the average seam thickness as 4 ft. 7 in. including over 2 ft. of shale; however, the colliery plans show limits of workings in the Watson Seam which was apparently worked from No. 3 Shaft at a later date. The limits of workings on a seam known as the "New" Seam are also shown on these plans. A reference to this seam by Ball indicates that it is identical with the Jewel Seam.

Reliable information about the remainder of the Torbanlea Collieries is available from only two sources —the Annual Reports of the Department of Mines and the colliery plan.

Torbanlea No. 1 Tunnel was originally the Churchett Torbanlea Coal Company's Colliery. It was driven to the Jewel Seam which was reported to be of excellent quality, ranging in thickness from 5 ft. to 7 ft. including two bands of stone. Surveyed levels show that the seam dipped at a grade of 1 in 7½ in a direction N. 55 degrees E. No. 2 Tunnel was also driven on this seam.

No. 3 Tunnel worked the Burrum Seam to the rise of the original workings from No. 1 Shaft. No seam sections in these workings are available. No. 4 Tunnel and No. 5 Shaft both worked the Torbanlea Seam. They were located at the north-western end of the old workings. In both cases, bad roof and heaving floor conditions forced the abandonment of the pits. No. 5 Shaft was later re-opened by the Woodley Syndicate to work a seam 56 ft. above the Torbanlea Seam. This upper seam is shown on the plans as the "Bridge" Seam, but this correlation is extremely doubtful since the interval between the Bridge and Torbanlea Seams in 220 ft. at the Burrum River, and 158 ft. in the Torbanlea No. 2 Shaft. It seems more likely that the seam worked in No. 5 Shaft is equivalent to an unnamed seam passed through in Torbanlea No. 2 Shaft in a similar stratigraphic position 76 ft. above the Torbanlea Seam. The section of this seam in the dip, 100 yards from No. 5 Shaft was said to be 3 in. top coal, 9 in. band, and 9 in. bottom coal. A stone band 4 in. thick was encountered on the north-western side, and on the south-eastern side a level was driven 150 yards, the seam comprising 2 ft. 6 in. of clean coal. No. 5 Tunnel was then opened up on the same seam south-east of No. 5 Shaft.

Nos. 6 and 7 Tunnels were both driven to the Torbanlea Seam; the former holed into old workings from which the pillars were extracted and the latter opened up virgin ground to the north-west of the old workings. No seam sections are available. In No. 7 Tunnel, three seams were penetrated—the so-called Bridge Seam, the Dirty Seam, and the Torbanlea Seam. The workings on the Torbanlea Seam were the most extensive. The stratigraphic position of the Dirty Seam is not known.

Torbanlea No. 8 Tunnel was in a different locality, about ½ mile south-east of Torbanlea near the North Coast Railway. This tunnel opened up a small seam, previously worked in the Two-Mile Colliery, and about 500 ft. higher stratigraphically than the Bridge Seam. The seam section was reported to range in thickness from 2 ft. to 2 ft. 6 in. including, in places, a stone band about 2 in. thick. Surveyed levels indicate that the seam dips at a grade of 1 in 7½ in a direction N. 45 degrees-50 degrees E.

Burnbank and Wilston Collieries.—These collieries were in the same locality as Two-Mile Colliery. At the Wilston Colliery the seam was probably the same as that worked at Two-Mile. Thickness ranged up to 2 ft. 6 in. averaging approximately 2 ft. 3 in. The seam section in the air shaft at 83 ft. was 2 ft. 2 in. coal. Over the greater part of the colliery, roof conditions were bad. On the south-eastern side two faults with downthrow of 6 ft. and 4 ft. to the south-east were encountered. The average grade of the seam was 1 in 8 to the north-east. Wilston was closed in 1939.

The seam worked at Burnbank Colliery is reported to be idnetical with the Two-Mile–Wilston Seam. It dipped at a grade of 1 in 8 in a direction N. 35 degrees E. On the colliery plan the seam section at the race of the main dip is given as 15 in. coal. In the south-eastern levels, 22 chains from the haulage tunnel it ranged from 18 in. coal (with boulder) to 20 in. coal. No other sections are shown on the plan, but it is probable that the seam was much thicker over the greater part of the colliery than the sections given which are in marginal areas.

The Howard Area:

General.—The Collieries within this area extend in a north-westerly direction along the outcrop of the Productive Section for a distance of approximately 3 miles from the Burrum River (See Figure 2B). With one exception—Burgowan No. 11 Colliery—they are all located on the south-western limb of the Burrum Syncline. Burgowan No. 11 Colliery is located on the north-eastern limb just west of the Burrum River.

The oldest workings were primitive openings from the river-banks, followed by shallow pits of the daylight type such as that worked by Steley. No information is available about these. The first shaft of importance in this area was Whitley's which was the first of the Burrum Colliery shafts. These are all in the north-western part of the area. In the south-eastern part, Dudley Colliery, which was opened up by a co-operative

group, was the first, followed by Clyde Colliery. Dudley Colliery was later known as the Dundee Colliery. In 1918 Gauchalland Colliery began operations on a seam previously worked in one of the Dundee Collieries and in 1921 Bellefield Colliery opened on another of the Dundee working seams. Following the closure of Bellefield in 1927, no mining was done in this part of the field till 1952 when Rankin Colliery commenced mining. At the present time there is one colliery—Burgowan No. 11—working in this area.

The Dundee (Dudley) Collieries.—The first shaft was sunk about the year 1886 and the colliery was closed four years later after 3 shafts had been completed. It was reopened in 1907 by the Burrum Co-operative but closed again in the following year. In 1909 it was taken over by the newly-formed Dundee Coal Company and was worked continuously as Dundee Colliery till it closed finally in 1926. The records of the early workings, including seam sections, seam correlations, and depths of shafts are confused. Ball (1902) recorded the following information:—

The No. 1 Shaft was sunk to a depth of 200 ft. and a bore was put down from the bottom of the shaft a further 80 ft. A poor seam was passed through at 60 ft. from the surface; and at the bottom of the bore 2ft. 6 in. of coal was penetrated. Other seams were considered too thin to be of interest. These two seams were correlated by Ball with the Torbanlea and Watson Seams. A bore (No. 1) 17 chains to the rise of the shaft was said to have penetrated a seam at 54 ft. from the surface which Ball correlated with the Jewel Seam. Another bore (No. 2) located 4 chains north-east of the shaft passed through a seam of coal 5 ft. thick at an unrecorded depth, but this seam was said to be missing in the shaft section. A third bore (No. 3) 20 chains to the rise of the shaft penetrated 3 ft. of coal, which Ball considered to be the Watson Seam, at a depth of 53 ft. 6 in. No. 2 Shaft was sunk to a seam which comprised 1 ft. 6 in. top coal, 3 ft. shale band, 1 ft. 6 in. coal, 3 ft. 6 in. shale band, and 2 ft. coal. This seam which was 61 ft. from the surface was thought by the Syndicate to be the Torbanlea Seam and by Ball to be the Jewel Seam. A third shaft, located between Nos. 1 and 2 was sunk to a seam at 180 ft. which Ball correlated with the Watson Seam.

The seam at 60 ft. in No. 1 Shaft is shown on old mine plans as the Bridge Seam, and Thomas (1919) gives the depth of the Torbanlea Seam in that shaft as 250 ft.

The following is the writer's correlation of the seams worked in the various shafts:—The highest seam in No. 1 Shaft (60 ft.) is probably the Torbanlea Seam, as the shaft appears to be located behind the crop of the Bridge Seam and the depth corresponds to the expected position of the Torbanlea Seam. This same seam was later worked in Gauchalland Colliery to the dip of the Dundee workings. The seam at 61 ft. in the No. 2 Shaft may be the Burrum Seam; but a more acceptable correlation equates it to one of the thin seams between the Burrum and Jewel Seams; the coal sections at 250 ft. in No. 1 Shaft, 180 ft. in No. 3 Shaft and 54 ft. in the first bore probably all represent the Jewel Seam; and the seam at 280 ft. in No. 1 Shaft (and bore) and at 53½ ft. in the third bore would then correspond to the Watson Seam.

The colliery plans show the seams to be dipping at a grade of 1 in 5 to 1 in 6 in a direction N. 55 degrees E. A fault encountered on the western side of the workings trended approximately N. 50 degrees E. Downthrow was to the west but the displacement is not recorded.

In addition to the workings from the three shafts, the Dundee Coal Company operated two collieries from inclined tunnels. One of these tunnels was driven to the middle of the three seams worked in the shafts —probably the Jewel Seam—and the other was driven to the Hartley Seam which lies below the Watson Seam. The only sources of information about these collieries are the mine plans and the annual reports of the Department of Mines. No seam sections are shown on the plans of either colliery. The plan of the (?) Jewel Seam workings shows two small faults, one trending N. 25 degrees E. with upthrow to the west and the other trending N. 60 degrees E. with downthrow to the west, on the western side of the tunnel. A shale band 3 to 8 inches thick is reported to have appeared in the seam in the deeper (northern) part of the workings. No information is available about seam sections in the Hartley Seam workings which were reported to have broken through in one place into Steley's old daylight level workings.

In 1917 three diamond drill holes were bored in the vicinity of the Dundee Collieries, but, because of low core recoveries, the seam sections recorded in these bores are not reliable.

Gauchalland and Bellefield Collieries.—Immediately to the north of the Dundee Collieries were the Gauchalland and Bellefield workings, owned by the Queensland Collieries' Company Ltd. Gauchalland, which was opened in 1918, and closed in 1922, worked the highest of the Dundee working seams (? Torbanlea Seam) from two vertical shafts (Nos. 18 and 19) to the dip of Dundee No. 1 Shaft. No details of the seam are available except that its depth in No. 18 Shaft was 150 ft. and that it was split up by shale bands on the south-eastern side near the Dundee workings. The colliery workings extended about 25 chains to the north-west along the strike from No. 18 Shaft and were passed through in the Bellefield Shafts (Nos. 22 and 26).

Bellefield Colliery was located to the dip of one of the Dundee tunnels, the same seam (? Jewel) being worked in both collieries. The first shaft (No. 22) was sunk in 1921. In the second shaft (No. 26) the depth of the working seam was 258 ft. and of the Gauchalland Seam approximately 150 ft. Annotations on the colliery plan show that at the face of the No. 1 north-west level the seam comprised 24 in. top coal and 9 in. bottom coal with a middle shale band of unrecorded thickness; and at the face of

No. 2 north-west level there were 15 in. top coal, 16 in. shale, and 10 in. bottom coal; in the bottom (No. 4) north-west level the seam comprised 23 in. coal.

The colliery closed in 1927 due to flooding.

The Clyde Colliery, Beaufort Shaft and Howard Shaft.—Clyde Colliery commenced about 1892 when it was leased by the Queensland Collieries Company for a period of 4 or 5 years. The seam worked during this time was known as the Beaufort Seam. Ball (1902) referred to two tunnels 6 and 10 chains long respectively and the colliery plan shows a third tunnel marked "old tunnel" about 10 chains south of the other two. The worked area extended along the crop a distance of 19 chains, but did not extend more than about 3 chains to the dip. Three seam sections are shown on the plan. One, in the top level near the middle tunnel, shows 4 in. top coal, 3 in. band, 4 in. coal, 9 in. band and 12 in. bottom coal. Near the air shaft, the depth of which is given as 60 ft. the section recorded is 8 in. top coal, 25 in. band, and 9 in. bottom coal. At the dip face in the most northerly tunnel, the section was 4 in. top coal, 4 ft. 6 in. band, and 6 in. bottom coal.

This seam was penetrated in the Beaufort and Howard Shafts at depths of 50 ft. and 51 ft. respectively. Rands (1886A) reported that the seam was 4 ft. 5 in. thick with a thin band of shale. He referred to workings on this seam from an inclined tunnel which was probably the "old tunnel" shown on the colliery plan. This seam is probably the same as the top seam worked at Dundee, and in Gauchalland Colliery.

Ball (1902) reported that a shaft near the outcrop of the Beaufort Seam had cut a second seam 3 ft. thick at a depth of 150 ft. This is probably the seam worked at Clyde from about 1905 to 1915. Sections shown on the plan show a shale band up to 34 in. thick splitting the seam in the southern part of the workings. The section in the bottom north-western level 5 chains from the tunnel comprised 33 in. clean coal, but at the face of the bottom south-eastern level, 5 chains from the tunnel, the seam comprised 12 in. coal, 34 in. shale, and 12 in. coal. About a chain closer to the tunnel the section was 15 in. top coal, 12 in. stone and 14 in. bottom coal. On the south-eastern side of the tunnel, near the crop, two more sections are shown. These are 16 in. top coal, 12 in. stone, 14 in. bottom coal and 9 in. top coal, 16 in. stone, and 12 in. bottom coal. This seam may be the middle seam at Dundee Colliery which was also worked at Bellefield Colliery.

The Briton Shaft.—This was located 18 chains to the dip of Howard and Beaufort Shafts and was intended to cut the Beaufort Seam at greater depth. It was abandoned at a depth of 320 ft. which was below the expected depth of the seam, the absence of which was explained by faulting. It is possible, however, that the Beaufort Seam was passed through in the shaft but was not recognised owing to rapid deterioration of the seam.

The Glenesk Shaft.—Rands (1886A) reported that this shaft, situated approximately 50 chains west of Howard Railway Station was sunk to a seam 18 in. to 2 ft. thick known as the Glenesk Seam. This was correlated with a seam exposed in the banks of a creek running into the Burrum River near the old road crossing. No other information about this shaft is available.

The Burrum Colliery.—This colliery, the most extensive in the field, was situated north of the town of Howard (See Figure 2B). Three seams, known as Nos. 1, 2 and 3 Seams in descending order, were worked, No. 2 Seam being the main producer, followed by Nos. 1 and 3 Seams in that order. The colliery commenced production some time prior to 1878 when an inspection of the field was made by A. C. Gregory. The colliery was temporarily closed at that time and the shaft (Whitley's) was full of water. This shaft was unfavourably located in a small down-faulted area and was abandoned when the Queensland Land and Coal Company took over the colliery. No. 1 Company Shaft was completed in 1883. In 1885, the Queensland Collieries Company, Ltd., took over the property which was worked continuously till 1923 from a series of vertical shafts, the last to operate being No. 24 Pit.

No. 1 Seam was known also as the Beaufort Seam, having been correlated by the Company with the seam worked from the Beaufort and Howard Shafts. This correlation must be considered doubtful. No. 1 Seam was worked from Nos. 5, 15, 20, and 24 Shafts. According to company records it was passed through at the following depths: 50 ft. in No. 5 Shaft, 140 ft. in No. 15 Shaft, and 70 ft. in No. 20 Shaft. The depths of No. 2 Seam in these shafts is given as 275 ft., 220 ft. and 126 ft. respectively, or 225 ft., 80 ft., and 56 ft., respectively below No. 1 Seam.

Plans of the workings on No. 1 Seam are available, but little detail is shown. No. 5 workings, lying to the dip of the shaft, were bounded to the east and south-east by faulting. To the rise of these were No. 24 Pit workings where sections shown on the plan show a range in seam thickness from 24 to 31 in. To the north were Nos. 5 and 15 Pit workings where seam thickness ranged usually from 2 ft. to 2 ft. 6in., including a median stone band 3 to 9 in. thick. In some small areas the thickness increased to 3 ft. or even 3 ft. 6 in.

The discrepancy in the intervals between Nos. 1 and 2 Seams in the north and south of the colliery suggests that the "upper" seam workings may actually be on different seams in these two localities. As sections of only two shafts (Whitley's and No. 1) are available comparison of the stratigraphic columns in the northern and southern parts of the colliery is not possible.

No. 2 Seam which was the main working seam was originally correlated with the Burrum Seam. Fryar (1900) disagreed with this, suggesting that the Torbanlea and Burrum Seams had come together in

this area and that these combined formed No. 2 Seam; later correlations by the Queensland Collieries Co. Ltd. equated No. 2 Seam with the Torbanlea Seam. The presence of No. 3 Seam a few feet lower in the sequence and in the expected position of the Burrum Seam favours this correlation. No. 2 Seam was the original working seam in Whitley's Pit where it comprised 6 in. top coal, 1 ft. stone, and 3 ft. bottom coal, the depth of the floor being 114 ft. 2 in.

Nos. 1, 5, 8 and A Pit workings were inspected by Ball (1902) and his report has provided most of the information obtained about the southern part of the colliery. No. 1 Shaft passed through No. 2 seam at 212 ft. the section comprising 6 in. top coal, 1 ft. 1 in. shale, 1 ft. 1 in. coal, 1 ft. 6 in. shale, and 11 in. bottom coal. The workings were all to the north and west of this shaft as shale or clay bands prevented development to the east and south. In No. 5 Pit workings the seam showed greatly increased thickness, comprising 6 ft. of clean coal at the shaft and 5 to 7 ft. of coal with lenticular stone bands over a small area in its vicinity. Because of this improvement, workings were continued further to the dip (east) from this shaft, although one of the stone bands near the roof increased rapidly in thickness in this direction. About 7 chains to the dip of the shaft, this band was 12 in. thick and in a further 7 chains it had increased to 18 in. The thickness of the coal ranged up to about 4 ft. usually comprising about 6 in. to a foot top coal, and 3 ft. to 3 ft. 6 in. bottom coal. A section shown on the plan near the dip face, approximately 24 chains from the shaft, was 8 in. top coal, 2 in. stone, 11 in. coal, 2 in. stone, and 12 in. bottom coal. This indicates considerable thinning of both coal and stone in the dip workings.

To the rise of these workings is No. 8 Pit which worked only a small area. Near the shaft the seam comprised 6 ft. 6 in. of coal without any stone bands. This thickness decreased to 4 ft. a short distance from the shaft. No. 21 Pit was later sunk to the west of No. 8 Shaft to recover a small area of coal left in early workings but no details of the seam in this area are available. About 30 chains north of this group of shafts was A Pit. The seam section at the shaft recorded by Ball was 4 ft. top coal (including stone bands) 18 in. stone, and 4 ft. bottom coal. At the time of his inspection relatively little development had been done at this pit. To the dip the tendency was for the bottom coal to remain fairly constant at 3 to 4 ft. with the top coal decreasing to about 6 in. and the middle band increasing in some places to as much as 3 ft. 6 in. Sections shown on a plan of later workings further to the dip were as follows:

Coal 5–6 in.
band 3 in.
coal 10–12 in.
band 3 in.
coal 9 in.
band 10–26 in.
coal 5 in.

To the rise of the shaft a section measured by Ball comprised 1 ft. top coal, 6 to 12 in. coaly shale, 3 ft. 4 in. coal 2 in. shale, 6 in. coal, 18 in. shale, and 4 in. coal. A section shown on the plan at the limits of the workings about 12 chains north of the shaft was 15 in. top coal, 2 in. stone, 7 in. coal, 5 in. stone and 3 in. bottom coal.

The A Shaft was the most northerly at the time of Ball's inspection and he noted that, in this area, the strike was beginning to swing round from north-east closer to north. This trend was continued in the more northerly later workings. There was marked irregularity in both grade and direction of dip. The grade ranged from almost flat to 1 in 3, the average being about 1 in 6.

In No. 15 Pit workings the only sections shown on the plan were measured at the boundaries of the colliery where the seam is usually inferior to the majority of the worked area. These sections show 10 to 12 in. top coal, 3 to 6 in. stone and 10 in. bottom coal. Miners say that the seam averaged about 5 ft. in thickness including some shale bands. At the more northerly No. 20 Pit this seam was not worked extensively, only prospecting headings being developed. The depth to the seam in this shaft was 126 ft. and seam thickness was approximately 2 ft. including shale bands.

The No. 3 Seam was the least extensively worked seam at the Burrum Colliery. Ball recorded that it was worked from the Nos. 1, 4, and 8 Pits and it was subsequently worked from Nos. 5, 15, 20 and 23 Pits. Apparently in the earlier workings it was developed more or less in conjunction with the No. 2 Seam, being reached by stone drives from that level. Ball described No. 3 Seam in No. 8 Pit as 2 ft. 6 in. of clean coal. A section shown on the plan 4 chains to the dip of No. 8 Shaft was 2 ft. 9 in. coal. This was the main seam worked in Nos. 20 and 23 Pits which passed through it at depths of 142 ft. and 131 ft. respectively. The seam thickness ranged from about 19 in. clean coal in the east to 3 ft. 9 in., including 2 stone bands, in the north-eastern part of the workings. Average total thickness of the seam was about 2 ft. 6 in. Company records give the interval between the Nos. 2 and 3 Seams in the No. 20 Shaft as 16 ft.

Seams below No. 3 Seam were passed through in bores from the bottom of Nos. 8 and 23 Shafts and in a staple shaft from the No. 15 Pit workings. Ball's record of the No. 8 Pit bore shows that No. 3 Seam, comprising 2 ft. 4 in. coal, was 8 ft. 6 in. below No. 2 Seam. Twenty feet below the No. 3 Seam was a seam 3 ft. 2 in. thick including 2 in. shale in the middle. At an interval of 30 ft. 6 in. below that seam was another which comprised 9 in. top coal, 3 in. shale, 1 ft. coal, 5 ft. shale, and 6 in. bottom coal. The bore was continued to a depth of 150 ft. below the

floor of the shaft (No. 2 Seam) but apart from the seams detailed above, only thin bands of coal were intersected. Company records of a bore from the bottom of No. 23 Pit list only one potentially workable seam which was 57 ft. below No. 3 Seam and 188 ft. from the surface. This seam comprised 7 in. top coal, 2 ft. 8 in. stone, 1 ft. 3 in. coal, 2 in. stone, and 9 in. bottom coal. A staple shaft sunk from the dip section of No. 15 Pit workings is said to have passed through a seam of coal 4 ft. 6 in. thick, including approximately 6 in. shale in the middle, at an interval of 18 ft. below No. 3 Seam, but there is no written record of this shaft.

The Rankin Colliery.—The Rankin Tunnel, located approximately 6 chains east-south-east of Burrum Colliery No. 1 Shaft, was opened in 1952 by the Queensland Collieries Company, Ltd., to work a small seam which was expected to average about 3 ft. in thickness. The seam exposed in the workings was of inferior quality and very lenticular and the colliery was closed in September, 1955. Seam thickness within the colliery ranged up to 3 ft. 6 in. including inferior coal and shale bands (Hawthorne 1954C). The middle part of 9 to 15 in. was of uniformly good quality, but the top and bottom sections were generally inferior, containing a high percentage of finely-banded coal and shale known locally as "rattlejack". Lenticularity was most noticeable in the lower part of the seam. The seam section in No. 1 south-eastern level, 2 chains from the tunnel, measured 4 in. top coal (partly inferior), 1 in. shale, 9 in. coal, 1 in. shale, 2 in. coal, ½ in. shale, 2 in. coal, 1 in. shale, and 4 in. bottom coal. Roof and floor were shale. In No. 1 north-western level approximately 2 chains from the tunnel the seam comprised 2 ft. coal, ½ in. shale, 2½ in. inferior coal, ½ in. brown shale, 8½ in. inferior coal. Roof and floor were again shale. Of 7 diamond drill holes which prospected it, only one, located approximately 18 chains east-north-east of the adit entrance, passed through a workable section of the working seam.

A small seam lying below the working seam at intervals ranging up to 16 feet was not thick enough to be considered workable in the colliery area. Its thickest development was in a drillhole located approximately 16 chains N. 37 degrees E. of the adit entrance where the section was as follows:—

2 ft. 1½ in. coal and inferior coal
2 in. shale
10 in. coal and shale
4 in. shale
3 in. coal

Four of the drill-holes prospected another seam lying approximately 120 ft. below the working seam but again only one potentially workable section was found. This section with a total thickness of 3 ft. 7 in. including 9 in. shale was in a drill hole located approximately 28½ chains in a direction N. 82 degrees E. from the adit (Hawthorne, 1955A).

The correlation of the Burrum Colliery Seams with sections drilled at Rankin is in doubt. In the one deep bore at Rankin (N.S. 26) the following were the main coal sections penetrated:—

189 ft. 10 in. to 192 ft. 1 in.	8 in. coal 3 in. shale 9 in. coal Rankin Seam 4 in. shale 3 in. coal
243 ft. 1 in. to 245 ft. 6 in.	10 in. coal 7 in. shale 1 ft. 0 in. coal
313 ft. 4 in. to 316 ft. 11 in.	1 ft. 0 in. coal 5 in. shale 6 in. coal 6 in. shale 1 ft. 2 in. coal
388 ft. 7 in. to 389 ft. 8 in.	6 in. coal 6 in. coaly shale 1 in. coal
393 ft. 11 in. to 426 ft. 9 in.	Thin coal bands in a predominantly shale sequence
428 ft. 3 in. to 434 ft. 2 in.	5 in. coal 3 ft. shale 1 ft. 2 in. coal 1 ft. shale 4 in. coal
438 ft. 6 in. to 441 ft. 2 in.	1 ft. 5 in. coal 11 in. shale 4 in. coal
555 ft. 3 in. to 557 ft. 1 in.	6 in. coal 3½ in. shale 3½ in. coal 3 in. shale 6 in. coal

The Rankin Seam is not present in Burrum No. 1 Shaft. It probably lies 40 to 60 ft. above No. 1 Seam worked from No. 5 Shaft. As suggested earlier, this name (No. 1 Seam) has probably been applied to different seams in the northern and southern parts of the Burrum Colliery; and it is possible that the seams at 243 ft. and 313 ft. in N.S. 26 represent these two seams worked as No. 1 Burrum Seam. The thick section of coal and shale at 388 ft. to 441 ft. in N.S. 26 is probably to be correlated with the Burrum Nos. 2 and 3 Seams and the unworked sections just below them in No. 8 Shaft bore. Correlation of lower seams in Nos. 8 and 23 Shaft bores with lower seams in N.S. 26 is impossible on the data at present available.

A deep bore (N.S. 13) was also drilled to the dip of No. 15 Shaft workings. No. 1 Seam is probably represented in this drillhole by a thin coaly section at 234 ft. and Nos. 2 and 3 Seams by a coal and shale sequence between 276 ft. 6 in. and 288 ft. There are only two thin coal seams below this to a total depth of 634 ft. These seams, at approximate depths of 350 ft. and 530 ft., each consist of only a few inches of coal. A further possibility is that the seam at 350 ft. represents the No. 3 Seam.

The Burgowan No. 11 Colliery.—This colliery, which commenced work in March, 1956, is the only one at present operating in the Howard area. It is also the only colliery in this area to be located on the north-eastern limb of the Burrum Syncline.

The seams have not been traced at the surface from one limb of the syncline to the other and closure at this end of the syncline is not yet proved. The generalised sequence bored at Burgowan No. 11 bears little resemblance to that at Burrum Colliery and, in addition, correlation of seams within the mine area itself is complicated by faulting and by lenticularity of the sediments. Suggested correlations with the Burrum Colliery seams are shown on Figure 3. This area is extensively faulted. Fractured and slickensided strata with steep dips were encountered in four of the holes drilled at Burgowan No. 11.

A reverse fault, with upthrow of 6 ft. to the west was passed through at the level of the upper seam in the cross-measure drift which was driven parallel to the strike of the seam. A second reverse fault with upthrow to the south-west of approximately 6 ft. was encountered in the main dip heading in the upper seam approximately 130 yards from the adit. This fault trends north-west. Another fault, with estimated upthrow to the east (of 30 ft.) is indicated by the Burgowan Coal Company's boring campaign. This fault probably trends in a general north-west direction at approximately 14 chains east of the adit. Other faulting of greater magnitude occurs in the area to the south of the adit between N.S. 50 and N.S. 53, the seams at N.S. 53 being thrown up approximately 40 ft. The trend of this fault which is located near the margin of the workable area is probably east-north-east.

The seams dip in a south-south-westerly direction at grades ranging from 1 in 6 to 1 in 12.

A deposit of unconsolidated river sand and gravel overlies the greater part of the proposed mine area on the eastern side. It ranges up to about 70 ft. in thickness, its base being, in some places, almost 30 ft. below present day sea level.

The Burgowan Coal Company expects to work two seams about 120 ft. apart. At the present time only the upper seam has been fully opened up. Reserves of coal in this seam are of the order of 60,000 tons. In the higher parts of the workings the seam section measures 3 ft. 3 in. to 3 ft. 9 in. including a persistent shale or coaly shale band about 10 in. to a foot from the top of the seam. This band averages 3 in. in thickness ranging up to 7 in. In No. 2 W. level, approximately a chain from the main dip heading the section comprises 12 in. top coal, 3 in. coaly shale, and 2 ft. 6 in. bottom coal. The seam is overlain by coaly shale. A few yards to the dip of this level the seam thickness begins to increase, reaching a maximum of 5 ft. In the dip heading, this thickening of the seam is accompanied by a reversal of dip, due to faulting. At this point, 130 yards from the cross-measure drift, the seam is dipping gently to the north-east and the section comprises 1 ft. 6 in. top coal, 1 in. shale, 7 in. coal, 8 in. inferior coal and 2 ft. bottom coal. This fault has been penetrated and proved to be a reverse fault with upthrow to the south-west of approximately 6 feet.

The lower seam is expected to be the main working seam at Burgowan No. 11. It is thicker than the upper seam being up to 5 ft. in overall thickness, including 4 ft. of coal. In borehole sections at least one and frequently two shale bands are present. The upper has a maximum known thickness of 1 ft. 6 in. and the lower when present is usually only a few inches thick. The section where the cross-measure drift penetrates the seam is 6 in. coal, 1 ft. 6 in. shale, 3 ft. 3 in. coal. The potentially workable area of this seam, proved by company boring and by diamond drilling, is approximately 60 acres, the greater part of which lies to the east and south of the adit. Reserves of workable coal are approximately 320,000 tons.

Because much of the surface is below flood-level, the adit has been located on the western side of the proposed mine area and has been driven in a direction parallel with the strike of the seams.

Several other seams passed through in the bores, are not considered to merit further prospecting at the present time. One seam approximately 25 ft. below the lower working seam may be workable in the western part of the mine area.

The Area North East of Torbanlea:

General.—Coal Mining in this part of the field commenced in 1910 at Bellert's Burgowan Colliery about 3 miles north-east of the town of Torbanlea. In 1913 another small colliery, known as North-East Colliery, was opened up on the same seam. Since then five more seams have been worked, and at the present time 2 of the 5 working collieries in the field are located in this area. (See Figure 2C.)

From a study of the microspore assemblages in the working seams de Jersey (1951) established the following succession:

Quentin Seam
Portland No. 1 Seam
Portland No. 2 Seam
Ellangowan Seam
Jubilee Seam

These seams lie below that worked at Bellert's Burgowan Colliery (Bellert's Beelbi or Sore-eye Seam) and occupy a position in the formation similar to that of the seams in the Torbanlea and Riverbank Collieries. They are lower in the succession than the Burnbank—Wilston Seam. Other seams occur within the sequence, but up to the present time there has been no determined effort to work them, at least in this part of the field.

In this area seam correlations can be made with certainty; and for that reason colliery descriptions have not been presented separately as in the other working areas but have been grouped in the respective seam descriptions.

Bellert's Beelbi or Sore-Eye Seam.—This is the highest seam worked extensively in this area. Local miners speak of workings on a higher seam—the Lagoon Seam—but apparently these were quite small and there is no record of them. Bellert's Seam was

worked at *Burgowan* Nos. 1, 2 and 3 and *North-East Collieries,* where it was typically 2 ft. 6 in to 3 ft. in thickness, and free from stone bands. When the Burgowan Nos. 1, 2 and 3 Collieries were flooded in 1920, these workings were abandoned and no collieries have since been established on this seam.

The Quentin Seam.—This seam, lying approximately 120 ft. below Bellert's Seam has been worked in two collieries—*Quentin* and *Burgowan No.* 7. These adjacent collieries together form the second largest working area on any seam in the field. Quentin Colliery was operated from 1921 to 1931 by the Queensland Collieries Company; Burgowan No. 7 was opened in 1926 and is still being worked.

As Quentin Colliery is closed it could not be inspected and all information about this colliery has been taken from Company records and the Annual Reports of the Department of Mines.

Records of preliminary hand-boring at Quentin indicate that seam thickness near the crop ranged up to 6 ft. 6 in. In the deeper parts of the colliery, the seam thinned on the north-western side where it averaged 3 ft. 3 in. On the south-western side, adjacent to Burgowan No. 7, it averaged approximately 6 ft. The seam carried two stone bands, neither of which was persistent throughout the colliery. The aggregate thickness of these bands seldom exceeded 6 in. A thin clay band was present in the seam in some parts of the colliery; it was more persistent further to the south-east at Burgowan No. 7.

Two minor faults were encountered at Quentin, both of which trended N.W.-S.E., that is, almost parallel to the strike of the seams. The maximum displacement recorded was 8 ft. Throughout the colliery the seam had an average grade of 1 in 4·8 in a direction N. 215 degrees E.

At Burgowan No. 7 the seam thickness ranges from 3 ft. 9 in. to nearly 8 ft. The seam is badly banded near the crop but most of the bands disappear at depth, only two persistent ones remaining. Other bands appear in places but these are erratic. The thickest sections of coal are in the north-western part of the colliery; but the lower levels on this side encountered the same faults as were met at Quentin. On the south-eastern side of the tunnel the seam section is, in general, thinner than on the north-western side and, in addition, a coaly shale band, which occurs in the bottom part of the seam, increased so rapidly in thickness that the bottom section of coal cannot be worked in this part of the colliery. The thickness of the worked section above this coaly shale band ranges from 4 to 5 ft. In boreholes N.S. 11, ahead of the tunnel and N.S. 8, about 25 chains to the south-east, the interval between the bottom section of coal and the worked section had increased to approximately 6 ft. The maximum known thickness of this band within the colliery limits is approximately 10 ft. The clay band which was present in parts of Quentin Colliery is present throughout Burgowan No. 7, where it lies about the middle of the seam. It is usually only an inch or so thick. Sometimes a shale band is present in the coal between this clay band and the floor of the worked section. A section measured in No. 6 level, approximately 32 chains south-east of the tunnel was as follows:

3 in coal
3 in coaly shale
1 ft. 3 in coal
½ in. carb. shale
8½ in. coal
1 in. carb. shale
1 ft. 7 in. coal
1 in. white clay
1 ft. 2½ in. coal

Approximately 10 chains from the tunnel in No. 9 S.E. level the following section was measured:

7 in. coal
½ in. grey shale
2 ft. 0 in. coal
1½ in. brown clay
4½ in. coal
3 in. shale
8 in. coal

At both these places the bottom section of coal was not exposed. At N.S. 11, located 44 chains from the adit on a bearing N. 195 degrees E., the following section was drilled:

2 ft. 3 in coal
1 in. coaly shale
1½ in. coal
½ in. grey shale
3½ in. coal
5 in. grey shale
8 in. coal
6 ft. 11 in. shale
7½ in. coal
2 in. grey shale
6½ in. coal

In all other diamond drill-holes in this area the Quentin Seam had deteriorated due to thickening of the shale bands and also to thinning of the coal. Throughout the colliery the seam dips at an average grade of 1 in 5½ in a direction N. 200 degrees E.

With the exception of the faults also encountered at Quentin no major displacement of the seam occurred in the north-western levels at Burgowan No. 7 Colliery. Development of the south-eastern levels has been stopped by a disturbed zone which is probably a continuation of a known fault at the Ellangowan Colliery. This faulted and folded zone trends in a north-north-easterly direction approximately parallel to the direction of dip. Resultant displacement calculated from the reduced levels of the seam in diamond drill-holes appears to reach a maximum of 40 to 50 ft. at Burgowan No. 7 Colliery, decreasing to almost nothing further to the south-south-west. The eastern side of the fault is the down-thrown side.

The Portland No. 1 Seam.—The Portland No. 1 Seam underlies Quentin Seam at an interval ranging, where known, from 20 ft. to 150 ft. In the mine area to the dip of Burgowan No. 7 Colliery workings, this interval ranges from 20 ft. to 110 ft. over a distance of 35 chains. This seam is the most extensively worked in this part of the field, having been worked in *Newfield, Woodhill, Portland and Burgowan No. 9 Collieries*; and at depth a new working area has been proved which is accessible from Burgowan No. 7 Colliery. The thickness of Portland No. 1 Seam is uniformly small, maximum recorded being at Burgowan No. 9 where it ranges up to about 3 ft. 9 in. and averages 3 ft. 4 in. The seam is usually free of bands although one appears in parts of Portland and Burgowan No. 9 Collieries.

Information concerning Newfield, Portland and Woodhill which are abandoned has been obtained from Queensland Collieries Company records and from the Annual Reports of the Department of Mines.

Newfield Colliery which was the first pit to work this seam was opened in 1924. The shaft penetrated the seam at a depth of 42 ft. and a lower seam at 130 ft. The Newfield workings were not extensive, being confined on the west by the lease boundary and on the east by a fault. The main dip tunnel also finished against this fault which was later penetrated by a drive; but haulage difficulties caused the abandonment of the colliery in 1930. The thickness of the seam ranged from 3 ft. to 3 ft. 6 in. in all parts of the workings. Average grade was 1 in 5 in a direction slightly west of south.

The fault on the eastern side of the workings displaced the seam 58 ft. in the drive which penetrated it, the Newfield side being displaced downwards relative to the eastern block. It trends approximately N. 40 degrees E.

Woodhill Colliery, established in the same year as Newfield was also worked from a vertical shaft which cut the seam at approximately 180 ft. The seam here ranged from 2 ft. 3 in. to 3 ft. 6 in. and averaged about 3 ft. in thickness. Small faults are shown on the colliery plan along part of the western limits of the workings; however, as bores and headings proved a thinning of the seam in this direction, these faults were not penetrated. Average grade of the seam was 1 in 5½ in a direction 30 degrees west of south.

Between Woodhill and Newfield was the Portland Colliery which was established in 1930 to work the Portland No. 1 Seam east of the Newfield Fault. The seam thickness in this colliery ranged up to 3 ft. 3 in. In the deeper parts, a "floating" band up to 6 in. thick was present near the floor. Most of the western levels were driven as far as the Newfield Fault. On the eastern side development was limited by thinning of the seam. Development to the dip was discontinued because of increased costs due to the presence of gas and the hardness of the coal. Average dip of the seam was in a direction 30 degrees west of south at a grade of 1 in 6½.

The fourth colliery to open up this seam—Burgowan No. 9—closed recently. It commenced about 1937 and was worked till 1948 under lease by the Burrum East Syndicate, during which time it was known as the Burrum East No. 2 Colliery. It was subsequently worked by the Burgowan Coal Company. The seam was not as uniform in this colliery as it was in the others although in the greater part of the colliery it was 3 ft. to 3 ft. 6 in. thick. A thick ironstone band, possibly identical with the one in Portland, is present in the seam at Burgowan No. 9. Most of the eastern levels were continued as far as the lease boundary, but on the western side thinning of the seam halted development. The main dip tunnel was stoped when the seam in the dip face had decreased to 1 ft. 9 in. thick. No faulting of importance occurred in this colliery. The roof, in some places, was very bad, comprising fractured brown shale overlain by coaly shale and then sandstone.

The grade of the seam is irregular ranging from 1 in 12 to 1 in 6 in a direction N. 195 deg. E.

An area of workable coal lying to the dip of Burgowan No. 7 workings has been proved in Portland No. 1 Seam by diamond drilling and non-core drilling (Hawthorne 1954A). The interval between Quentin and Portland No. 1 Seams near Burgowan No. 7 haulage tunnel is approximately 30 ft. As the proved reserves do not approach closer to the surface than 350 ft., access to Portland No. 1 Seam is by cross-measure drift from this tunnel. The seam has been proved workable to a vertical depth of 760 ft. with average seam thickness of 3 ft. A band of shale up to ½ in. thick near the middle of the seam in the central part of the area did not appear in the marginal boreholes but a thicker band of shale is reported in some of the Burgowan Coal Company's boreholes in the north-western part of the mine area. The seam was also reported to be thicker in some of these holes.

Reserves of 580,000 tons of coal were proved by this drilling without defining the absolute limits of workability, except on the northern side.

Average grade throughout the area is 1 in 6½ in a direction N. 190 degrees E. The fault zone encountered in the eastern levels at Burgowan No. 7 appears to continue through the eastern part of this mine area.

The Portland No. 2 Seam.—The next lowest of the working seams is Portland No. 2 Seam, which, in the vicinity of Portland Collieries, is approximately 65 ft. below Portland No. 1 Seam. It has been worked in four collieries in this part of the field, none of which is now operating. Characteristically this seam comprises up to 3 or 4 thin bands of coal separated by thick beds of shale with a total thickness of the order of 30 to 40 ft. In some areas one or more of the shale sections thin out or disappear allowing two or more coal sections to be worked simultaneously. In other areas workable thickness is attained by thickening of one or other of the coal sections.

Diamond Drill Core, N.S. 63, Burrum Coalfield.

Burgowan No. 4 *Colliery* which was commenced in 1920 was the first to work Portland No. 2 Seam. Access was by an inclined tunnel. In the air shaft the depth to the floor of the seam was 46 ft. The colliery plan shows that the seam in the upper level ranged from 5 ft. 6 in. to 6 ft. 6 in. of clean coal and that thickness decreased to the west where levels were stopped when the section measured approximately 2 ft. A band of stone, which appeared in No. 4E. level, ranged up to 7 ft. in thickness and the lower levels were driven in the bottom section of coal where the thickness was 2 ft. 4 in. to 3 ft. The upper coal section was worked over a small area near the eastern boundary of the colliery from a drive put in from the bottom coal workings. The thickness averaged about 2 ft. 6 in. These top coal workings were abandoned when a thick band of stone appeared on the western side. The colliery was closed in 1935.

Burgowan No. 6 *Colliery,* located to the east of Burgowan No. 4, worked the same seam. In the north-western part of this pit, the seam comprised up to 7 ft. of clean coal. In the lower levels on this side and in most of the eastern levels, the same band as was encountered in Burgowan No. 4 split the seam and there the top section of coal was worked. The bottom section was worked only in patches. In Burgowan 4 and 6 Collieries the average grade of the seam was 1 in 6 to 1 in 7 in a direction slightly west of south.

Burgowan No. 5 *Colliery,* located approximately ½ mile westerly from Burgowan No. 4 also worked Portland No. 2 Seam. This colliery was abandoned when the coal thinned to the dip, partly because swelling of the floor made operating conditions difficult. No seam section is recorded.

Portland No. 2 *Colliery* was originally worked from a vertical shaft but an inclined tunnel was later driven to the seam on the eastern side of the shaft. The seam worked near the shaft averaged 2 ft. 9 in. to 3 ft. in thickness and was reported to increase slightly to the dip. Below this were 3 ft. of shale with thin coal bands, 1 ft. coal, 10 in. shale, and 1 ft. 5 in. coal. Approximately 7 chains east of the shaft, a north-north-east trending fault displaced the seam 9 ft., the eastern side being thrown down. To the east of this fault the seam was much improved, the worked section being up to 7 ft. thick including a stone band ranging from 2 in. to approximately 2 ft. in thickness. Two thin clay bands were also present in some places; the upper one was the more persistent of the two, frequently running into the large stone band which splits the seam. The section in No. 1E. level, 20 chains east of the inclined tunnel was 3 ft. 10½ in. thick including 2 in. coaly shale at 2 ft. from the floor. At the face of No. 1E. level the seam comprised 4 ft. of poor quality coal. To the dip it thinned very rapidly, and in a diamond drill-hole 29 chains to the dip of the portal of the tunnel it comprised only a few thin coal bands. In another drill-hole, 34 chains south of the portal, the seam section was 1 ft. 4 in. top coal, 6 ft. 10 in. shale, 1 ft. 3 in. coal, 11 ft. 2 in. sandstone and shale, and 1 ft. 2 in. bottom coal. At 22 chains south-west of the old winding shaft, the seam comprised 9 in. top coal, 3 ft. shale, 1 ft. 11 in. coal, 2 ft. 9 in. shale, and 3 in. bottom coal.

The seam dips in a direction N. 205 deg. E. at an average grade of 1 in 5.

The Ellangowan Seam.—The next of the worked seams in the succession is the Ellangowan Seam lying approximately 90 ft. below Portland No. 2 Seam. It has been worked in only two collieries—*Burgowan No.* 8 (*Ellangowan*) and *Burgowan No.* 10—both of which are located in the western part of the area. Burgowan No. 8 closed in 1950 and Burgowan No. 10 closed recently.

In Ellangowan Colliery the seam ranged up to about 4 ft. 3 in. overall thickness, including two fairly persistent stone bands. Each of these bands is from 3 to 6 in. thick over the greater part of the colliery area.

In No. 1W. level approximately 4 chains from the tunnel the seam comprised 4 in. top coal, 2 in. shale, 10 in. coal, 6 in. shale, and 1 ft. 8 in. bottom coal. To the dip of this, in No. 2W. level and 5 chains from the tunnel the section was 11 in. coal, 3 in. stone, and 1 ft. 9 in. coal. On the other side of the colliery in No. 2E. level the section comprised 10 in. top coal, 6 in. stone, 1 ft. coal, 6 in. shale and 1 ft. 6 in. coal.

On the eastern side of the colliery, development was limited by deterioration of the seam due to increased thickness of the shale bands. On the western side the seam improved and was worked in the Burgowan No. 10 Colliery.

A fault with downthrow to the east was encountered in all the eastern levels at Ellangowan. This fault trends approximately south-west and is probably closely related to the faulting along the eastern boundary of Burgowan No. 7 Colliery. Displacement is reported to be of the order of 20 ft.

In Burgowan No. 10 Colliery the seam was thicker than at Ellangowan averaging approximately 3 ft. 8 in. with the section ranging up to nearly 6 ft. in some places in the higher levels and including as much as 2 ft. of stone. There is one persistent band a foot to 18 inches from the floor below which the coal is normally of better quality than the top coal.

The section in No. 1E. level at the boundary (adjacent to Ellangowan) was 3 ft. 3 in. top coal, 9 in. shale, and 8 in. bottom coal. At the extremity of No. 1W. level the seam measured 6 ft. 4 in. but was of poor quality. The section comprised 11 in. coal and stone (roof) 3 ft. coal, 1 ft. 6 in. shale, and 11 in. coal. In No. 4 west level, 9 chains from the tunnel the section was 9 in. shaly coal, 12½ in. coal, 1½ in. shaly coal, 1 ft. 8 in. coal, 6 in. shale with vitrain lenticles, and 1 ft. 3 in. coal.

The workings on the west side of the colliery and to the dip were stopped because of increasing thickness of shale bands accompanied by thinning of the coal.

Throughout the colliery the seam dips at an average grade of 1 in 6½ in a direction N. 190 degrees–200 degrees E. Faulting was present on the eastern side of the colliery but was of a minor nature.

The Ellangowan Seam has also been prospected in the East Victory Mine Area where a series of diamond drill-holes and power-boreholes (non-coring) were drilled primarily to test the underlying Jubilee Seam. In five diamond drill-holes and one power-borehole the Ellangowan Seam was of workable thickness; four diamond drill-holes passed through unworkable sections; and the seam was too shallow for adequate coring in the other diamond drill holes, which were designed to test the lower seam at shallow depths.

In this area the Ellangowan Seam comprises two coal sections separated by an interval ranging from 3 ft. 11 in. (N.S. 44) on the south-eastern side to 18 ft. 7 in. (N.S. 54) in the south-west. The positions of these drill-holes are shown on figure 2. The upper section of coal was of workable thickness at N.S. 42, N.S. 45, N.S. 54, N.S. 55, and N.S. 68 ranging from 2 ft. 10 in. coal (N.S. 54) to 3 ft. 5 in. including ½ in. shale (N.S. 42). The lower section was of workable thickness at N.S. 45 (3 ft. 3 in. coal) and N.S. 55 (2 ft. 3½ in. coal, 4 in. coaly shale, 6½ in. coal). Both sections were reported by the drillers to be of workable thickness in power-bore B1 where the interval between them was only 3 ft. 8 in. Further power-boring and possibly diamond drilling is to be done to test this seam in the East Victory area.

The Jubilee Seam.—This seam lies at an average interval of 120 ft. below the Ellangowan Seam. It has been worked only at the south-eastern end of the area in three collieries—*Jubilee, Victory* and *East Victory*.

Jubilee Colliery was commenced in 1934, the fiftieth anniversary of the formation of the Queensland Collieries Company Ltd. The shaft was sunk 183 ft. to the seam which there comprised 3 ft. of coal with ½ in. of stone 2 to 3 in. from the roof. To the west of the shaft and to the rise the seam section is fairly consistent but east of the shaft the coal thickness diminishes slightly and a band of stone, ranging up to 3 ft. in thickness splits the seam. The main haulage-way, which was driven to the south-west was turned south and then south-east when faults were encountered in the deeper parts of the colliery. Just to the rise of the fault the section comprised 2 ft. 3 in. top coal, 1 ft. 6 in. stone, and 2 ft. 3 in. bottom coal.

In the western levels two reverse faults were encountered. Downthrow of the seam to the west on the first fault ranged from practically nothing in the deeper levels to 18 ft. to the rise. One to three chains west of this, a second fault had similar displacement, with upthrow to the western side. In the resultant trough, the seam comprised 4 ft. to 4 ft. 6 in. coal with a median band of stone up to 6 in. thick. To the west of the second fault where it was penetrated in No. 4 west level, the stone band thickened almost immediately to 4 ft. limiting development to the west. Towards the bottom of the slope dip where both faults had almost disappeared, levels were driven to the west but were stopped when shale bands reached an aggregate of 2 ft. 2in. in a total section of 5 ft. Conditions at the face of the slope dip were similar. The coal reached its thickest development in the intermediate levels on the eastern side of the colliery where the seam ranged up 4 ft. 6 in. of almost clean coal. Further to the dip on this side, however, the seam was split by shale bands. Faulting, parallel to that on the western side, also occurs on the eastern side of the workings. A reverse fault with downthrow to the west cuts across the main dip and displaces the seam 10 ft. in some of the eastern levels but dies out to the rise of No. 7 E. level. A few chains further east most levels stopped at another small fault, the coal beyond it being later worked from the Victory Colliery. Throughout the Colliery the average grade is 1 in 6½ in a direction N. 200 degrees E. Jubilee Colliery was closed in 1954.

Victory Colliery, adjacent to Jubilee, was opened in 1942. Access was by means of an inclined tunnel. The seam was less consistent than at Jubilee in both quality and thickness. The stone band present in Jubilee thickened to over 7 ft. in parts of Victory and consequently the top section of coal has not been

worked in some areas. In other parts, particularly the north-eastern part of the colliery, sections of both top and bottom coal were of inferior quality. The greater part of Victory workings were to the east of the main haulage tunnel, the area to the west having been worked at Jubilee. The seam was best developed in the central part of the Colliery where the thickness ranges up to slightly more than 4 ft. of almost clean coal.

Development to the east was limited in the upper levels by excessive thickening of the stone band mentioned above and by thinning of the coal. Minor faulting is also present in this area. In the lower levels thickening of the included stone band was the limiting factor.

A small fault encountered on the eastern side of the Victory Colliery was penetrated by at least one level; but no further information is available.

The colliery was closed in 1950.

The Jubilee Seam at Victory Colliery dips at an average grade of 1 in 5½ in a direction N. 205 degrees E.

East Victory Colliery is located approximately half a mile south-easterly from Victory Colliery. A cross-measure adit, commenced in February, 1956, has been driven to intersect the Jubilee Seam at a vertical depth of approximately 110 ft. The seam there is 2 ft. 10 in. thick and in the small area opened up it ranges from 2 ft. 8 in. to 3 ft. A series of 10 diamond drill holes (N.S. 37 to 46 inclusive) was bored to test the Jubilee Seam in the proposed working area. Seven of these drill-holes penetrated workable sections of the seam proving measured reserves of 320,000 tons, in an area of 70 acres with an average seam thickness of 2 ft. 8½ inches. The seam thickness ranged from 2 ft. 7 in. clean coal (N.S. 39) to 2 ft. 11 in. clean coal (N.S. 38). No evidence of major folding or faulting in the mine area was disclosed by the drilling. The seam dips at an average grade of 1 in 4·3 in a direction N. 220 degrees E. (Hawthorne, 1956).

Roof conditions in the colliery workings are variable. In the western levels and to the dip shale overlies the seam. On the eastern side brown to dark grey siltstone with interbedded light grey sandstone bands forms the roof.

Three additional holes (N.S. 54 to 56 inclusive) were later drilled to the dip of the western side of these reserves, primarily to test the Ellangowan Seam. As the Jubilee Seam was of near workable thickness in two of these holes (N.S. 55 and N.S. 56) the measured reserves in this seam have been extended in this direction.

In this mine area the interval between the Ellangowan and Jubilee Seams ranges from 152 ft. to 168 ft.

In the East Victory Mine Area there are numerous small seams of coal interbedded with shale between the Ellangowan and Jubilee Seams. Nowhere within the area prospected do any of these attain workable thickness. The bands of coal between the Ellangowan and Jubilee Seams also occur in some other parts of the field and have been drilled in the Globe Mine Area and at Burgowan Nos. 4 and 6 Collieries.

These seams are not, however, as persistent as the worked seams and for that reason have not been named.

The Churchill—Globe Area:

General.—Two seams are being worked in this area (see Figure 2D). The higher which is worked at Churchill Colliery, may be correlated tentatively with the Quentin Seam and the lower worked at Globe Colliery, may be equivalent to the Portland No. 2 Seam. In diamond drill-holes at Globe Colliery seams which may be equivalent to the Portland No. 1, Ellangowan, and Jubilee Seams were also penetrated. With the exception of the Globe working seam, none of these seams was of workable thickness in the drilled area (Hawthorne 1954B).

The Churchill Colliery.—This colliery, owned by Howard Collieries Pty., commenced working in 1946. At the present time all development work has stopped and production is nearly all from pillar extraction. Access is by means of an inclined tunnel.

In the upper levels, the seam averaged over 5 ft. in thickness. In some places a lenticular band of grey shale, appeared, usually lying 6 or 7 in. from the top of the seam. Marginally the seam thinned out rapidly and in some places the thickness of the lenticular band increased to as much as 1 ft. 6 in. In the dip tunnel the seam thickness was fairly constant at 5 ft. to 5 ft. 6 in. for 13 or 14 chains from the portal, then deteriorated rapidly, being only 2 ft. thick at the dip face 16 chains from the portal. In the northern levels the seam decrease gradually in thickness, being unworkable 18 to 20 chains north of the tunnel. In the southern levels the seam thinned less rapidly than in the northern levels and in the two bottom levels on this side actually increased slightly after an initial thinning before decreasing again to unworkable thickness.

Typical of the seam in the colliery is the section measured in No. 3 South Level approximately 10 chains from the tunnel. This section was as follows:

2 in. shaly coal
5 in. coal
4 in. grey shale
4 ft. 0 in. coal

In the southern part of the colliery the seam dips at an average grade of 1 in 4·8 in a direction N. 265 degrees E. In the northern part the grade averages 1 in 4·1 in a direction N. 225 degrees E. The colliery is free of major faulting.

The Globe Colliery.—This colliery opened in 1951, works a seam, 160 to 180 ft. below the seam worked at Churchill, which may be equivalent to Portland No. 2 Seam. In support of such a correlation is the position of the seam in the sequence—apparently

the third seam—and the fact that it comprises 3 or 4 main coal sections in a succession of up to 30 ft. of coal and shale as does the Portland No. 2 Seam in the type area. The lowest of these coal sections forms the working seam at Globe.

Only a small area has so far been worked. In the main dip tunnel, the section for about 14 chains from the surface is approximately 4 ft. 5 in. thick, including a band of brown shale up to 2 in. thick which lies 13 or 14 in. from the top. Further to the dip a second band of shale appears about a foot from the bottom of the seam and thickens rapidly to the west and south while the bottom coal thins out. Consequently, only the section above this band is worked. This section is 2 to 3 ft. thick including 1 to 2 in. brown shale. In the Nos. 1 and 2 north levels the seam averages about 4 ft. in thickness. In the present No. 3 north level (20 chains from the portal) the bottom band thins rapidly north of the tunnel and the full section of the seam is worked. At about 4 chains north of the tunnel the section comprises 1 ft. 1 in. top coal, 1 in. shale, 1 ft. 5 in. coal, 9 in. shale, and 1 ft. bottom coal.

The brown shale band in the upper part of the seam is consistently present in the colliery and also appears in the sections in 4 diamond drill-holes to the dip of the workings. These holes, which are almost in line, are located approximately 30 chains to the dip of the crop of the seam. In the most southerly hole and one ahead of the main dip tunnel, the sections were essentially similar to the worked sections above the floor band in the main dip and the No. 1 south level, except that another thin band of shale is present 4 in. below the persistent brown shale band. The section of coal below the floor band has disappeared. In the hole 20 chains north of the line of the main dip tunnel, the seam is 6 ft. 3 in. thick, comprising 1 ft. 3 in. top coal, 2 in. brown and black shale, and 4 ft. 10 in. bottom coal. In the most northerly hole the persistent top band has increased in thickness and the section is as follows:—

10 in. coal
11 in. shale
3 feet 3 in. coal (shaly near base)

Logs of a series of 5 holes drilled in 1914 along the railway to the north of Globe showed only one workable section of this seam. This section comprised 1 ft. 6 in. top coal, 1 ft. 6 in. shale, 4 ft. coal, 1 ft. shale and 1 ft. bottom coal between 78 ft. and 87 ft. in No. 2 hole. Because of the poor core recoveries obtained in these holes, this is not regarded as a reliable record.

In an area of 170 acres, proved by the four departmental drill-holes and by handbores drilled near the crop of the seam by Howard Collieries Pty., reserves at Globe were estimated in 1954 as 1,117,000 tons, without absolute limits of reserves having been defined. (Hawthorne, 1954B).

In the colliery the seam dips at an average grade of 1 in 4½ in a direction N. 240 degrees E.

No workable sections, apart from those of the Globe Seam, were penetrated in the departmental drill-holes at Globe. The most promising of the unworkable sections was drilled in N.S. 17 at an interval of 394 ft. below the Globe Seam. It comprised 2 ft. top coal, 4 in. shale, 5 in coal, 5 in shale, and 2 in. bottom coal.

Miscellaneous Unworked Areas:

In the vicinity of Colton, a series of shallow boreholes, drilled by the Burgowan Coal Company, located the outcrop areas of the productive seams but failed to prove a mine area. A similar handboring campaign 1½ miles north-west of Colton prospected two seams less than 25 ft. apart and six diamond drill holes were bored to test these same seams at depth. The upper seam was of workable thickness in 3 of the 6 holes and the lower seam was of workable or near-workable thickness in two. The thickest section of the upper seam bored was in N.S. 22 where it comprised 3½ in. top coal, 2½ in. shale, 1 ft. 6½ in. coal, 1 in. shale, 2 ft. 1½ in. bottom coal. The thickest section of the lower seam was in N.S. 29 where 9½ in. coal, 2 in. shale and 2 ft. 4½ in. coal were cored. Because of the steep dip of the seams—approximately 1 in 2·3 to the north-east—and the thin seam sections, drilling in this area has been temporarily suspended.

An older (1920) series of 10 diamond drill holes was bored between this recently prospected area and the Burnbank Colliery in an attempt to prove sufficient reserves of coal for the establishment of a State Coal Mine in this Field. Bore logs show that only one bore penetrated a section of workable thickness. This was in Bore No. 3 where a section comprising 4 in. coal, 1 ft. 8 in. shale, 1 ft. 10 in. coal, 5 in shale, 1 ft. coal, 1 in. shale, 7 in. coal, 8 in. shale, and 7 in. coal was reported from 286 ft. 2 in. to 293 ft. 4 in.

A small colliery was commenced approximately 1¼ miles north-north-west of the Colton Railway Station but did not reach the production stage. The seam which was to be worked in this colliery is probably lower than that worked in Burnbank and may be in a similar stratigraphic position to the seams worked in Burgowan Nos. 1, 2 and 3 Collieries. It comprised 8 to 10 feet of coal with shale bands of which the bottom 2 ft. 9 in. to 3 ft. was to be worked. About 40 feet below this seam is another section of coal and shale bands.

To the south and east of Colton the outcrops of the productive seams have not yet been traced round the southern end of the syncline. The seams which crop out in Saltwater Creek do not belong to the productive section of the Coal Measures, being lower in the succession.

Between Globe Colliery and East Victory Colliery, the seams have not been fully prospected. Three diamond drill-holes were bored in 1915 near the middle of this area and subsequently one of the seams bored in these drill-holes were prospected at the crop by

hand bores. The results of the shallow bores indicated that the seam was unworkable at shallow depth and the core recoveries in the diamond drill-holes were insufficient for accurate determination of seam thickness. In the bored area the strata dip at grades of 1 in 3 to 1 in 3½ N. 222 degrees E.

A limited amount of shallow boring has been done between these drill-holes and East Victory Colliery and between the drill-holes and Globe Colliery without any workable area of coal being discovered.

Diamond drilling recently completed in this area approximately ½ mile north of the Pialba Branch Railway indicated, however, that a workable section of one seam exists at the 300 feet level over a distance of 25 to 30 chains. The seam deteriorates along the strike in both directions and also to the dip. Shallow drilling to the rise of the diamond drill holes may prove a small workable area of coal in this seam.

The outcrop area north-west of Quentin Colliery was prospected by a series of non-coring power bores without any workable areas of coal being found. A seam of potentially workable thickness was drilled in the northern part of this area but because of the proximity of the outcrop to the river the explorable area is too small to warrant the development of a new colliery under present conditions.

In this area a thick deposit of river sand and gravel, similar to that at Burgowan No. 11 Colliery, on the opposite side of the river, overlies the coal measures.

ECONOMIC SUMMARY

The investigation of the Burrum Coal Measures has now reached the stage where the greater part of the outcrop area of the main producing seams in the Burrum Syncline has been prospected by shallow non-coring boreholes by the three operating companies. Areas not prospected by this means are at the southern end of the syncline and work is proceeding there at the present time. Because of the disappointing results obtained by these methods departmental diamond drilling which normally follows shallow drilling by the companies has been mainly confined to areas lying north-east of Torbanlea.

Because of the complete absence of proved reserves at the commencement of the exploratory programme, mine areas proved to date have only replaced collieries which have closed down and no mine areas are held at present for future requirements. Three of the present operating collieries (Globe, Burgowan No. 11, and East Victory) are in comparatively early stages of development while Churchill and Burgowan No. 7 Collieries are in late stages of production.

As a result of the combined prospecting operations, five mine areas have been proved. Of these three were tested by diamond drilling without the aid of shallow boring or with subsequent shallow boring. Two of these mine areas are now producing and a third (East Victory-Ellangowan Seam) has yet to be developed. The Burgowan No. 11 Mine Area was proved by non-core company drilling and deep drilling was subsequently done in this area. This colliery has also reached the producing stage. The fifth mine area was proved at Globe Colliery which was, at the time of drilling, being opened up on the basis of shallow outcrop bores.

Unless further mine areas are located by the companies' boring programmes or by diamond drilling of areas previously tested by these shallow bores without success, (e.g. between East Victory and Globe Collieries) the search will probably be extended to other synclinal areas where the "Productive Measures" may have been preserved. Coal seams are known to be present in these areas but no serious attempt has so far been made to prospect them.

Some small seams in the "Unproductive Measures" may be potential producers but the problems associated with locating and prospecting these isolated seams are even greater than those associated with the seams in the "Productive Measures" where one borehole may test the full succession.

Correlation of seams has been a difficult problem but with the greater amount of boring now being done seam identification can now be extended from area to area with a reasonable degree of certainty. In this regard the major seams, although of workable thickness in only small areas, appear to be continuous throughout the field as coaly sections. Confusion often arises because of the appearance of other intervening but non-persistent seams. Marker bands are unknown. The use of sandstone beds for correlation is possible in some areas but not universally: e.g. the thick white sandstone overlying the Quentin Seam is distinctive in the vicinity of Burgowan No. 7 Colliery but further to the south-east a similar sandstone also overlies the Portland No. 1 Seam.

Known faults nearly all fall into two groups one of which trends parallel to the fold axes (N.N.W.) and the other almost at right angles to these axes.

The investigation has also furthered our knowledge of the Maryborough Formation which has been mapped as far north as Stockyard Creek. The estimated thickness of 6,000 ft., based on surface mapping, has been confirmed by the L.S.D. No. 1 Well (Cherwell Creek).

Both the Maryborough Formation and the Burrum Coal Measures are considered by the writer to have been deposited under geosynclinal conditions.

31st October, 1957.

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APPENDIX I

TABLE SHOWING ANNUAL PRODUCTION 1883-1956

Year	Tons	Men Employed
1883	6,440	44
1884	6,150	31
1885	26,914	126
1886	39,048	182
1887	45,527	194
1888	56,634	238
1889	48,267	275
1890	58,781	255
1891	42,516	193
1892	42,268	290
1893	54,075	304
1894	56,035	274
1895	75,299	289
1896	80,320	342
1897	77,301	316
1898	91,890	349
1899	111,414	284
1900	110,849	255
1901	111,972	328
1902	105,181	302
1903	99,292	301
1904	99,056	255
1905	98,594	332
1906	86,634	290
1907	77,921	211
1908	84,817	332
1909	92,573	295
1910	93,055	311
1911	98,827	323
1912	119,732	353
1913	129,611	386
1914	118,120	389
1915	104,358	373
1916	79,726	273
1917	72,282	268
1918	62,948	257
1919	63,665	266
1920	61,170	247
1921	69,633	281
1922	79,306	284
1923	74,215	260
1924	105,180	292
1925	119,704	367
1926	109,519	445
1927	96,345	401
1928	94,031	345
1929	146,247	406
1930	106,525	520
1931	64,379	428
1932	64,765	468
1933	66,697	457
1934	73,201	390
1935	82,707	389
1936	71,405	382
1937	79,229	353
1938	77,162	324
1939	101,967	342
1940	100,682	341
1941	114,190	325
1942	127,975	321
1943	136,541	367
1944	128,606	319
1945	113,578	298
1946	103,929	310
1947	139,447	344
1948	117,337	385
1949	136,009	325
1950	151,475	333
1951	160,263	335
1952	158,748	328
1953	147,388	311
1954	146,924	310
1955	135,338	289
1956	132,852	309
Total	6,822,761	..

APPENDIX II

TABLE OF COAL ANALYSES

(Analyses by the Government Analyst of Samples Prepared by the Writer)

Area	Seam	Proximate Analysis				Sulphur	Calorific Value B.T.U.'s/lb.	Specific Gravity	Swelling Index	Ash Fusion Temp.		Locality
		Moisture	Volatile Matter	Fixed Carbon	Ash					Softening Pt. °C	Fusion Pt. °C	
		%	%	%	%	%						
Torbanlea Howard	NO	ANA	LYSES	AVAI	LABL	E						
	Rankin Seam ..	2·3	30·5	55·6	11·6	0·45	13,060	1·352	8½(½gm)	..	..	Rankin Colliery Return airway No. 1 S. level
	Rankin Seam ..	2·4	28·5	48·8	20·5	0·37	11,460	1·430	7½(½gm)	..	..	N.S. 23 (Core Rec. 86·1%)
	Rankin Seam ..	2·4	30·3	53·4	13·9	0·42	12,650	1·368	8½(½gm)	..	..	N.S. 24 (Core Rec. 79·3%)
	Rankin Seam ..	2·1	30·9	49·9	17·1	0·36	11,920	1·411	6½	..	..	N.S. 25 (Core Rec. 100%)
	Burgowgn No. 11 Upper Seam	2·6	31·2	58·1	8·1	0·36	13,610	1·33	7	1,320	1,420	Burgowan No. 11 Colliery Station 47
	Burgowan No. 11 Lower Seam	2·0	31·7	58·9	7·4	0·53	13,820	1·32	7½	1,120	1,250	Burgowan No. 11 Colliery Station 57
	Burgowan No. 11 Lower Seam	1·9	28·6	56·5	13·0	0·48	12,830	1·36	8	1,160	1,250	N.S. 48 (Core Rec. 36·8%)
	Burgowan No. 11 Lower Seam	2·0	30·0	58·1	9·9	0·60	13,370	1·33	8	1,090	1,190	N.S. 50 (Core Rec. 72·7%)
	Burgowan No. 11 Lower Seam	1·9	29·6	55·4	13·1	0·71	12,920	1·33	8	1,170	1,260	N.S. 51 (Core Rec. 83·3%)
N.E. of Torbanlea	Quentin Seam ..	1·8	29·7	55·9	12·6	0·56	12,720	1·4	7	..	..	Burgowan No. 7 Colliery 6E. Level
	Quentin Seam ..	2·2	30·6	53·8	13·4	0·49	12,640	1·37	>9(½gm)	..	..	N.S. 8 (Core Rec. 90·2%)
	Quentin Seam ..	2·0	31·8	55·9	10·3	1·20	13,170	1·356	6(½gm)	..	..	N.S. 11 (Core Rec. 100%)
	Portland No. 1 Seam	2·7	31·6	60·7	5·0	0·65	13,990	1·425	7½	..	..	Burgowan No. 9 Colliery Return Airway 3W. Level
	Portland No. 1 Seam	1·7	30·9	60·2	7·2	0·55	13,760	1·319	7½(½gm)	1,360	1,440	N.S. 3 (Core Rec. 68·5%)
	Portland No. 1 Seam	2·0	32·2	58·4	7·4	0·57	13,790	1·315	9 (½gm)	1,160	1,240	N.S. 8 (Core Rec. 94·4%)
	Portland No. 1 Seam	1·6	30·4	58·0	10·0	0·56	13,400	1·337	8½(½gm)	1,130	1,170	N.S. 9 (Core Rec. 100%)
	Portland No. 1 Seam	1·8	29·5	59·5	9·2	0·54	13,590	1·332	6½(½gm)	1,330	1,410	N.S. 10 (Core Rec. 91·7%)
	Portland No. 1 Seam	1·9	32·6	60·5	5·0	0·55	14,200	1·301	8 (½gm)	1,020	1,070	N.S. 11 (Core Rec. 100%)
	Portland No. 2 Seam	2·7	30·8	58·7	7·8	0·74	13,650	1·381	7½	..	..	Portland No. 2 Colliery 1E. Level
	Ellangowan Seam	2·3	30·8	60·3	6·6	1·00	13,840	1·357	8½	..	..	Burgowan No. 10 Colliery 4W. Level
	Ellangowan Seam Top	2·0	31·1	58·1	8·8	0·58	13,460	1·331	..	..	..	N.S. 42 (Core Rec. 100%)
	Ellangowan Seam Top	2·1	29·7	56·1	12·1	1·15	12,850	1·375	7	..	..	N.S. 45 (Core Rec. 100%)
	Ellangowan Seam Bottom	2·0	31·2	54·3	12·5	0·68	12,560	1·386	8	..	..	N.S. 45 (Core Rec. 94%)
	Ellangowan Seam Top	2·4	30·5	55·1	12·0	0·72	12,990	1·361	7½	..	..	N.S. 46 (Core Rec. 68%)
	Ellangowan Seam Bottom	2·2	29·7	54·8	13·3	0·72	12,780	1·367	8	..	..	N.S. 46 (Core Rec. 100%)
	Ellangowan Seam Top	1·8	29·4	59·6	9·2	1·20	13,590	1·33	8	1,170	1,280	N.S. 54 (Core Rec. 90%)
	Ellangowan Seam Top	2·2	29·2	56·2	12·4	0·51	12,900	1·35	7½	1,340	1,480	N.S. 55 (Core Rec. 92%)
	Ellangowan Seam Bottom	1·7	31·1	59·6	7·6	0·49	13,920	1·29	8	..	..	N.S. 55 (Core Rec. 96%)

APPENDIX II—*continued*

TABLE OF COAL ANALYSES—*continued*

(Analyses by the Government Analyst of Samples Prepared by the Writer)—*continued*

Area	Seam	Proximate Analysis				Sulphur	Calorific Value B.T.U.'s/lb.	Specific Gravity	Swelling Index	Ash Fusion Temp.		Locality
		Moisture	Volatile Matter	Fixed Carbon	Ash					Softening Pt. °C	Fusion Pt. °C	
		%	%	%	%	%						
	Jubilee Seam ..	1·9	31·4	58·7	8·0	1·02	13,750	1·380	8	..	..	Jubilee Colliery 4W. Level
	Jubilee Seam ..	2·1	31·5	60·2	6·2	0·88	14,090	1·367	8½	..	..	Victory Colliery 3W. Level
	Jubilee Seam ..	2·0	31·7	57·9	8·4	0·55	13,530	1·325	..	..	..	N.S. 37 (Core Rec. 100%)
	Jubilee Seam ..	2·6	30·0	52·9	14·5	0·50	12,570	1·363	8 (½gm)	..	..	N.S. 38 (Core Rec. 100%)
	Jubilee Seam ..	2·6	29·9	54·2	13·3	0·51	12,750	1·362	7½(½gm)	..	..	N.S. 39 (Core Rec. 100%)
	Jubilee Seam ..	2·4	31·3	57·4	8·9	0·47	13,610	1·319	8½(½gm)	..	..	N.S. 41 (Core Rec. 100%)
	Jubilee Seam ..	1·8	28·3	51·2	18·7	0·42	11,890	1,415	..	..	..	N.S. 42 (Core Rec. 99%)
	Jubilee Seam ..	2·0	30·6	55·5	11·9	0·47	13,010	1·360	9	..	..	N.S. 46 (Core Rec. 100%)
	Jubilee Seam ..	1·4	29·7	60·7	8·2	0·49	13,840	1·31	8½	1,200	1,340	N.S. 55 (Core Rec. 94·5%)
Churchill Globe	?Quentin ..	2·3	30·4	52·9	14·4	0·72	12,370	1·320	7	..	..	Churchill Colliery 5S. Level
	?Portland No. 2	3·3	30·5	59·3	6·9	..	13,740	..	>9(½gm)	1,480	1,560	Globe Colliery Main Dip—160 yard from portal
	?Portland No. 2	1·5	29·3	56·4	12·8	0·60	13,080	1·362	8½(½gm)	..	..	N.S. 17 (Core Rec. 81%)
	?Portland No. 2	1·6	30·1	55·9	12·4	0·72	13,180	1·359	8 (½gm)	..	..	N.S. 19 (Core Rec. 100%)
	?Portland No. 2	1·6	30·0	58·3	10·1	0·60	13,490	1·346	8 (½gm)	..	..	N.S. 20 (Core Rec. 100%)
	?Portland No. 2	1·8	30·5	59·1	8·6	0·79	13,690	1·334	8½(½gm)	..	..	N.S. 21 (Core Rec. 100%)

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Torbanlea Colliery No. 3 Tunnel	**18**
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Torbanlea Colliery No. 5 Tunnel	**18**
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S. G. Reid, Government Printer, Brisbane.

FIG. 1

DEPARTMENT OF MINES · QUEENSLAND

GEOLOGICAL MAP OF THE BURRUM COALFIELD

To accompany a Report by W.L.Hawthorne B.Sc. Geologist

Scale of Miles

2 1 0 2 4 6

EXPLANATION

Roads and Tracks
Geological boundaries
Established
Approximate
Line of Geological Section A——B
Railways
Fault Established
Approximate
Dip of strata V6°
Anticlinal or Synclinal Axis (Approximate)

Quaternary Alluvium Q
Tertiary Lateritic soils Tl
Cretaceous Burrum Coal Meas. Kcb
Maryborough Formn. Kcm
Jurassic-Cret. Grahams Ck Formn. J-Kg
Triassic Tiaro Coal Meas. Jt
Myrtle Ck Sandst. Rm
Brooweena Formn. Rb
Granite etc Gr

D.W.S. & T.M.L. 30.9.1958

SECTION A-B

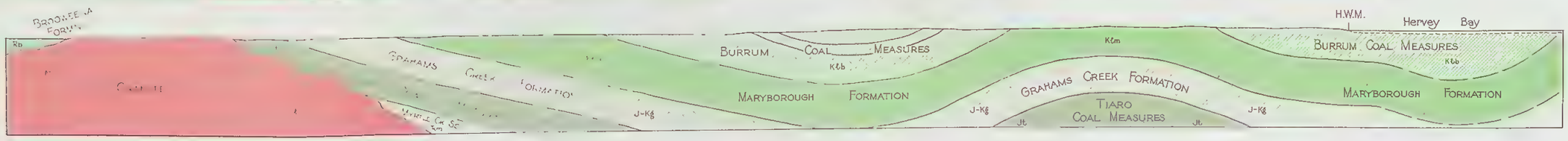


FIG. 2A

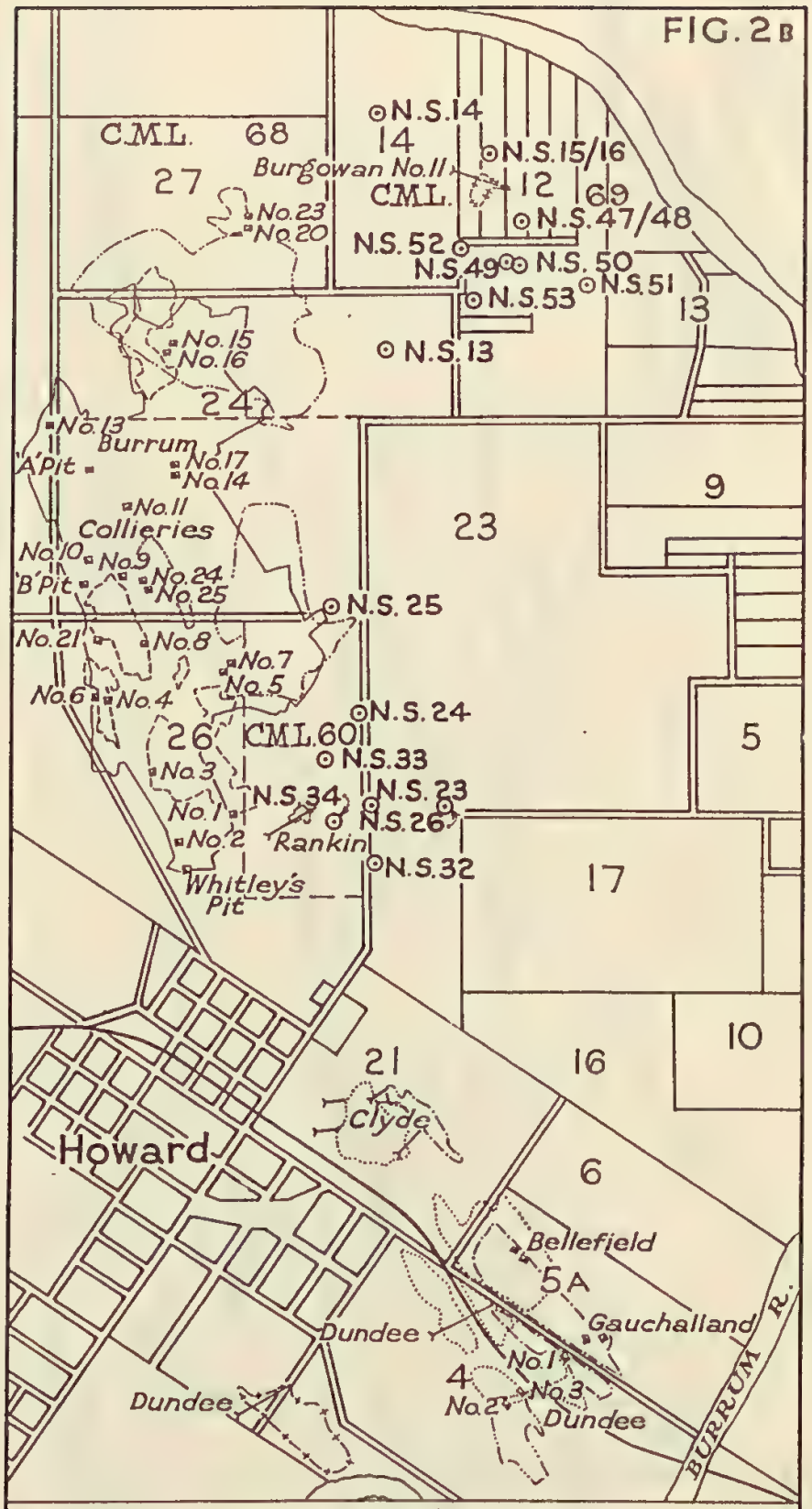
TORBANLEA AREA
BURRUM COALFIELD
Showing limits of underground workings

SCALE OF CHAINS
0 20 40 60 80

Burnbank Seam —·····—·····— Torbanlea Seam ——————
Two Mile Seam —+—+—+— Burrum Seam - - - - - - - -
? Bridge Seam —·—·—·— Jewel Seam .....
Watson Seam —··—··—··—

BURRUM R.
New Riverbank
Watson Shaft
NORTH COAST RAILWAY
2
Torbanlea
No.7 Tunnel
No.4 Tunnel
No.5 Shaft
12
No.5 Tunnel
No.6 Tunnel
Torbanlea Collieries
No.3 Tunnel
No.2 Tunnel
No.1 Tunnel
No.3 Shaft
No.2 Shaft
No.1 Shaft
19
33
No.8 Tunnel Torbanlea
34
Two Mile
C.M.L. 62
35
C.M.L. 61
Wilston
Burnbank
R.44
32v

FIG. 2B



HOWARD AREA
BURRUM COALFIELD

Showing limits of underground workings

SCALE OF CHAINS

0 20 40 60 80

Torbanlea Seam
Jewel Seam
Watson Seam
Hartley Seam
Rankin Seam
Burgowan No II Top S.

Burrum Colliery :
No.1 Seam
(Probably two distinct seams)
No.2 Seam (?= Torbanlea)
No.3 Seam (?= Burrum)

FIG.2c

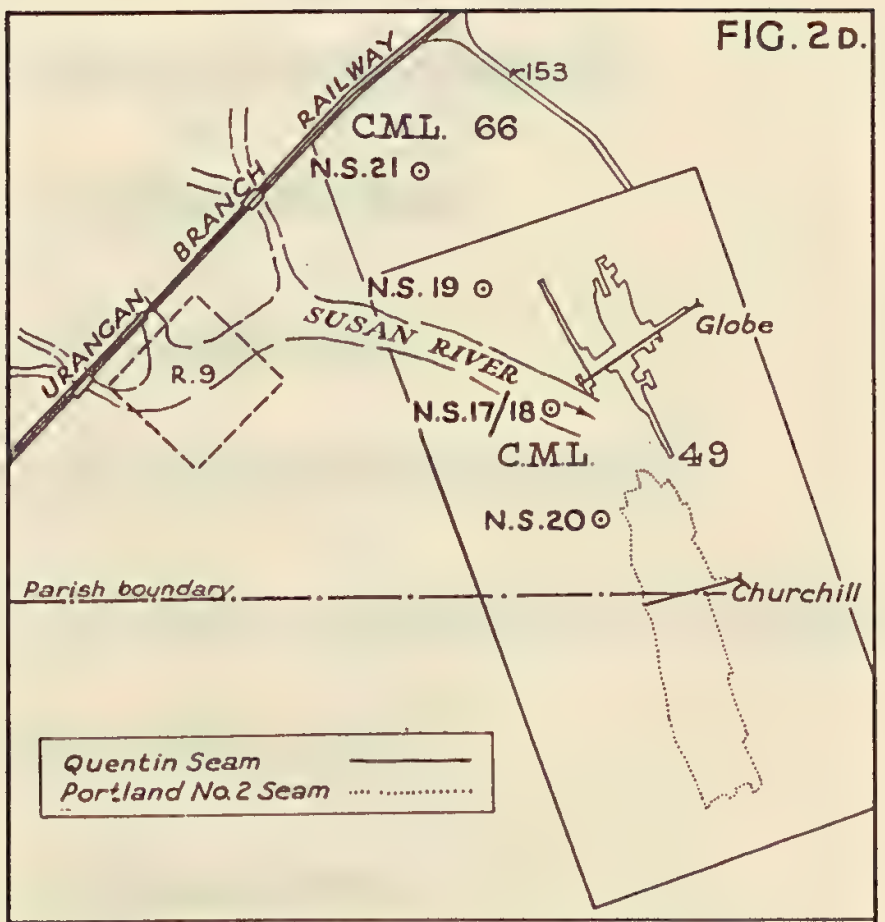
AREA NORTH-EAST OF TORBANLEA
BURRUM COALFIELD
Showing limits of underground workings

SCALE OF CHAINS
0 20 40 60 80

Bellert's Seam
Quentin Seam
Portland No.1 S.
Portland No.2 S.
Ellangowan Seam
Jubilee Seam

CML 47
CML 26
Burgowan No.10
CML 48
Quentin
Burgowan No.8
Burgowan No.5
Burgowan No.7
Burgowan No.4
29
28
CML. 19
N.S.30
Burgowan No.6
42v
C.ML. 20
N.S.4
N.S.1
N.S.11
N.S.2/3
N.S.12
North-East
N.S.31
Burgowan No.9
Burgowan No.2
No.1
No.3
3
Newfield
Portland
Portland No.2
C.M.L. 24
N.S.57
N.S.8
27
N.S.59
N.S.66
N.S.9
N.S.63
N.S.58
N.S.61
CML. 25
N.S.10
51
N.S.60
N.S.62
N.S.64
N.S.65
30v
N.S.7
N.S.6
Woodhill
N.S.5
Jubilee
Victory
East Victory
N.S.37
CML. 71
N.S.46
N.S.38
N.S.45
N.S.56
N.S.41
N.S.39
N.S.55
N.S.40
N.S.54
N.S.42
N.S.44
N.S.43
26
43
23

FIG. 2D.



CHURCHILL–GLOBE AREA
BURRUM COALFIELD

Showing limits of underground workings

SCALE OF CHAINS

0 20 40 60 80

FIG. 3

BORE SECTIONS WITH SEAM CORRELATIONS

HOWARD AREA — BURRUM COALFIELD

(Bore localities shown on Fig. 2B)

VERTICAL SCALE OF FEET

100 0 100 200

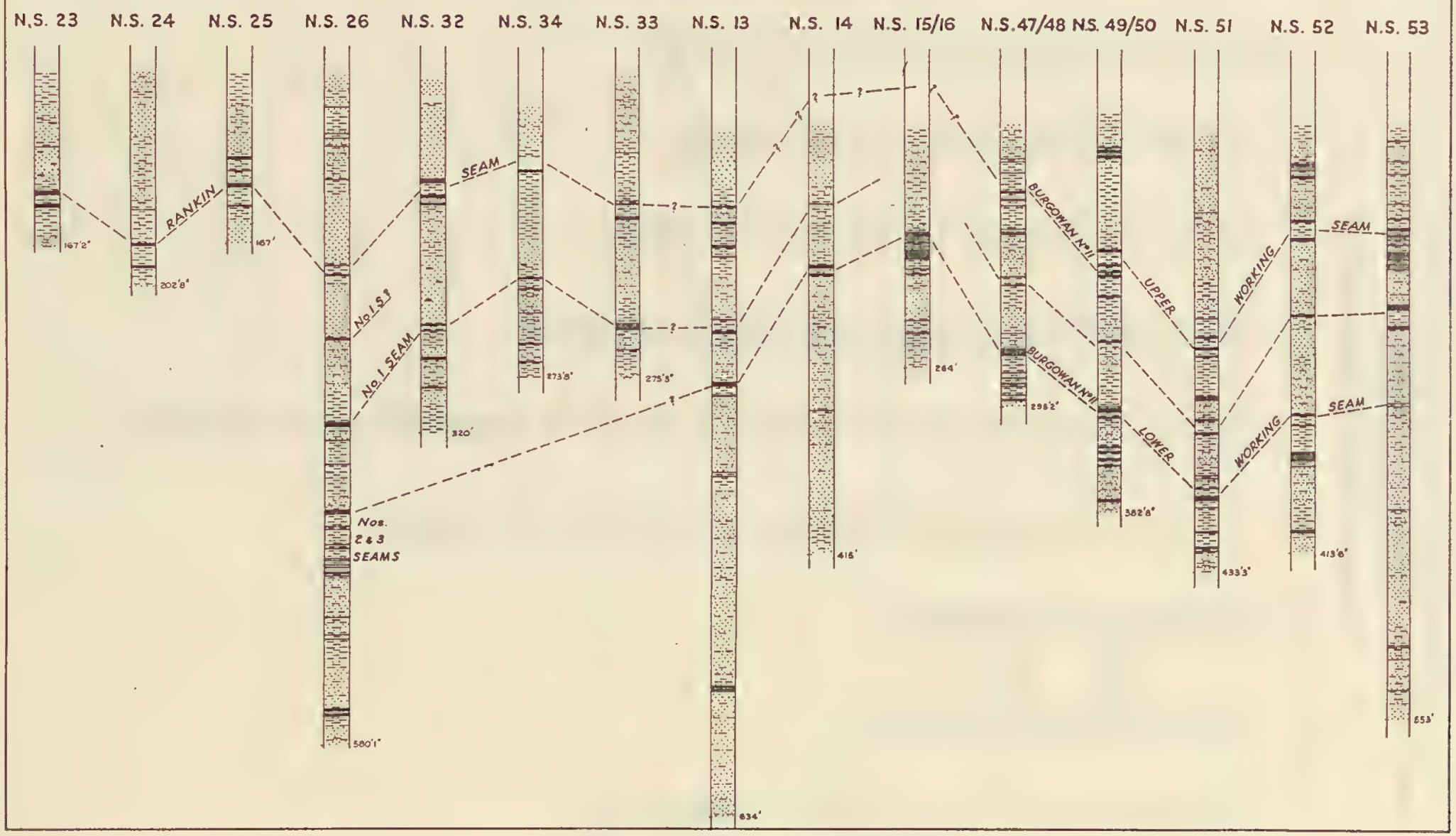


FIG. 4A

BORE SECTIONS WITH SEAM CORRELATIONS

AREA NORTH-EAST OF TORBANLEA — BURRUM COALFIELD Sheet A

(Bore localities shown on Fig 2c)

VERTICAL SCALE OF FEET

100 0 100 200

N.S. 4 | N.S. 1 | N.S. 2/3 | N.S. 12 | N.S. 11 | N.S. 8 | N.S. 9 | N.S. 10 | N.S. 30 | N.S. 31 | N.S. 5 | N.S. 6 | N.S 7

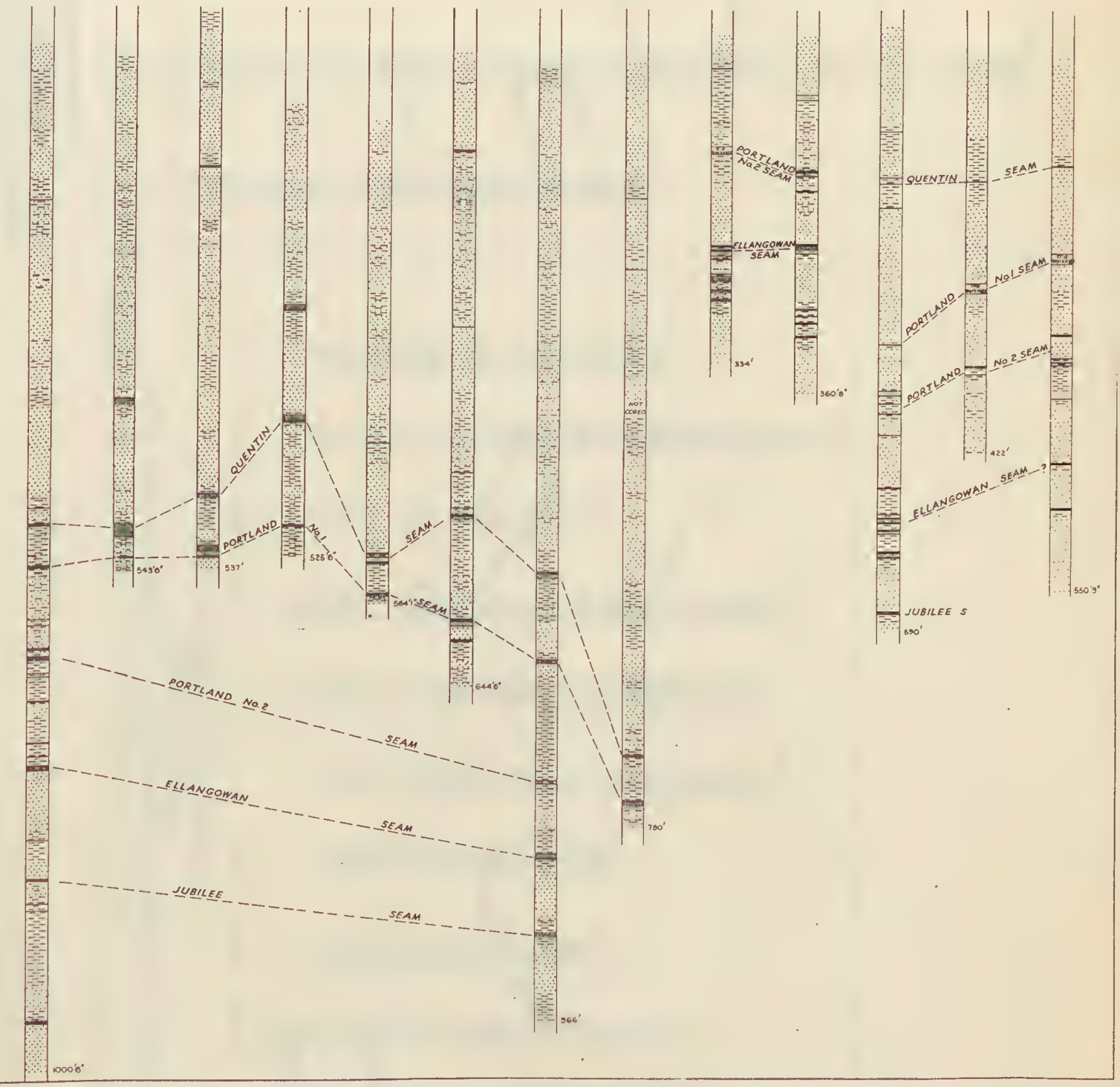


FIG. 4B

BORE SECTIONS WITH SEAM CORRELATIONS

AREA NORTH-EAST OF TORBANLEA — BURRUM COALFIELD Sheet B

(Bore localities shown on Fig. 2c)

VERTICAL SCALE OF FEET

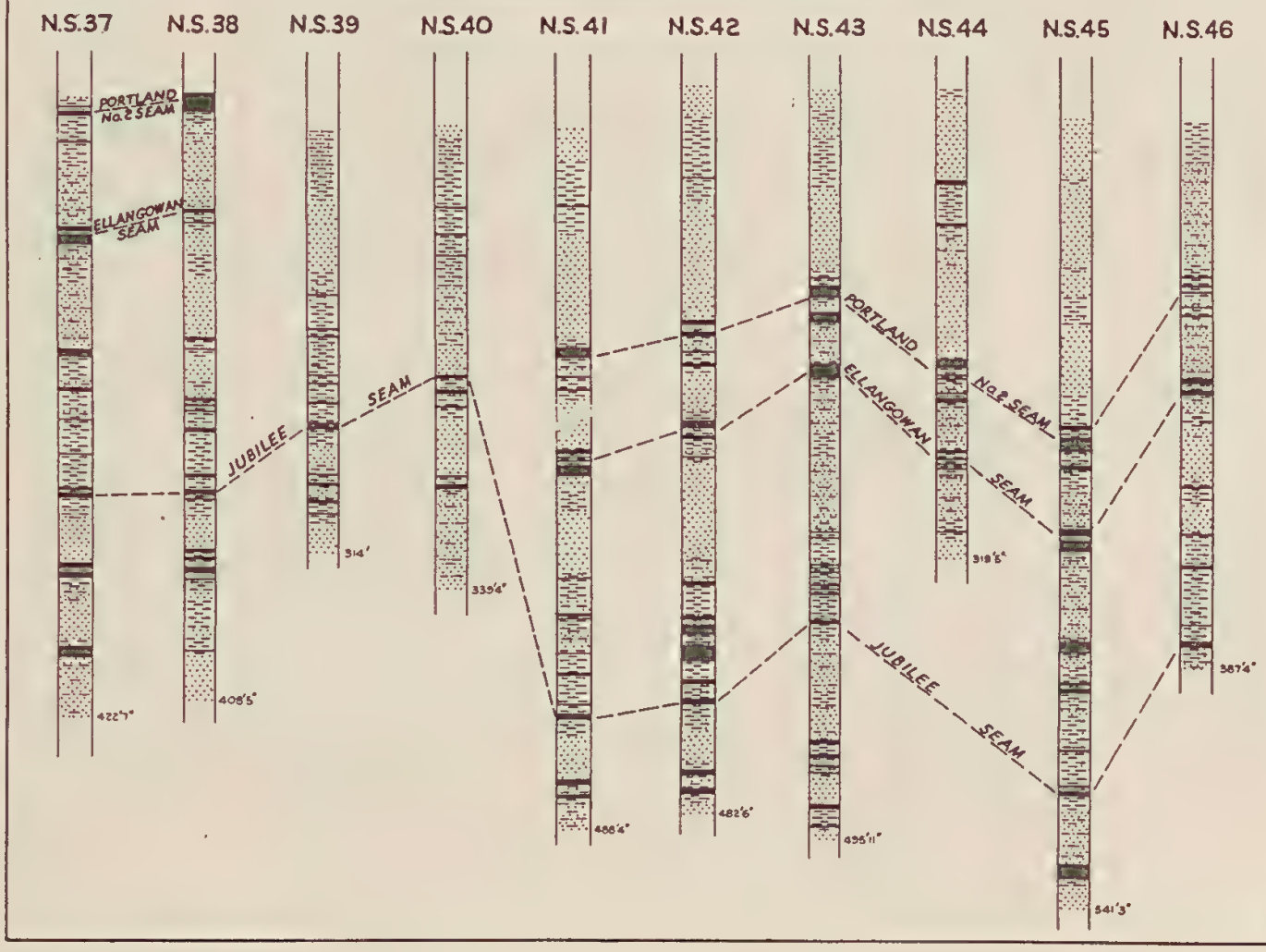


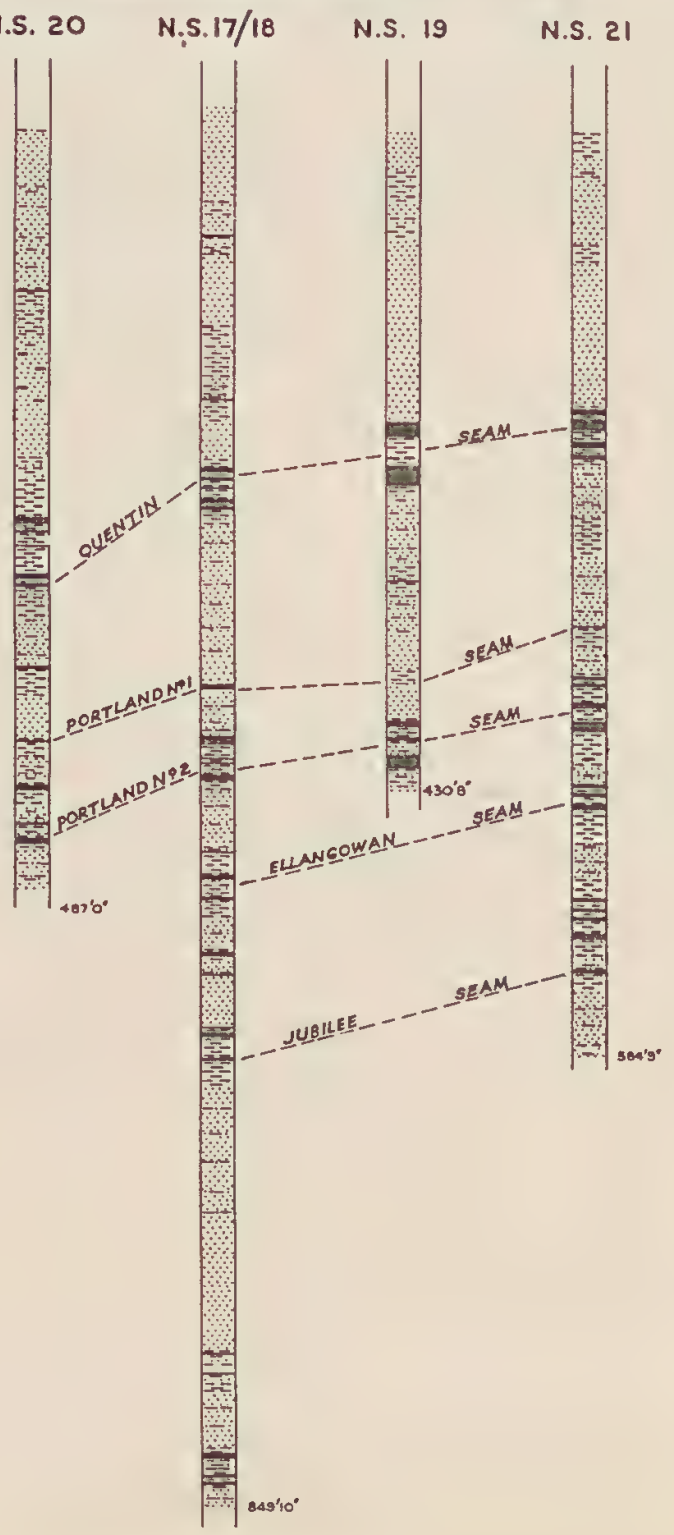
FIG. 5

BORE SECTIONS WITH SEAM CORRELATIONS

CHURCHILL-GLOBE AREA — BURRUM COALFIELD

(Bore localities shown on Fig. 2b)

VERTICAL SCALE OF FEET



QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 297

THE URANIUM DEPOSITS OF NORTH-WESTERN QUEENSLAND

By J. H. BROOKS, B.Sc.

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1960

View of Mary Kathleen open-cut looking north towards the treatment plant, 1959.

[*Photo. by C. H. Shipway.*

PREFACE

★

During the progress of periodic inspections of the uranium occurrences in North-Western Queensland over the past five years Mr. Brooks has amassed a wealth of detailed information on this important uranium province. This information, now presented in consolidated form, should prove of interest to a wide variety of readers.

The paper is in two parts : Part I. deals generally with the geology and other aspects of the deposits ; Part II. contains detailed descriptions of all the more important known occurrences.

Perhaps the most striking feature revealed by the paper is the persistent occurrence of uranium mineralization over a very wide area ; and, even though only one commercial deposit has so far been proved, it is believed that further investigation may well show some of the known prospects to be of commercial significance ; while the possibilities of further commercial discoveries can by no means be ruled out.

A. K. DENMEAD,
Chief Government Geologist.

Brisbane, 6th November, 1959.

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THE URANIUM DEPOSITS OF NORTH-WESTERN QUEENSLAND

By J. H. BROOKS, B.Sc., Geologist

ABSTRACT

The uranium mineralization occurs in the Precambrian mineral province of North-Western Queensland along the north-eastern margin of the Australian Precambrian shield. A prospecting boom in 1954 led to the discovery of the important *Mary Kathleen* deposit and open-cut mining of this deposit commenced late in 1956. Extensive airborne and ground search has been made by mining companies and the Commonwealth Government but most of the significant discoveries have been made by independent prospecting parties.

The great majority of the uranium deposits is confined to the Lower Proterozoic Eastern Creek Volcanics and Corella Formation. The distribution bears little relation to that of other metalliferous deposits although minor amounts of copper are commonly associated with uranium in some areas. Information is given on 180 occurrences of uranium and nearly all of these are distributed over an area of 11,000 square miles in the Cloncurry–Mount Isa district. The main features responsible for ore localization are favourable beds and fault structures. Various metamorphosed arenaceous and calcareous sediments and basic igneous rocks constitute the favourable bed in different deposits. An affinity between uranium and iron minerals is a noticeable feature in some groups of deposits. Secondary minerals are unimportant except in deposits in the Upper Proterozoic Westmoreland Conglomerate and the small *Milo* torbernite deposit near Cloncurry. Disseminated uraninite is the most important primary uranium mineral. It occurs associated with rare-earth minerals at the *Mary Kathleen*. The deposits are of the pyrometasomatic, hydrothermal replacement, and pegmatite types or are supergene concentrations. In some cases the deposits are clearly epigenetic and related to granite intrusion but for the most part evidence of genesis is not conclusive.

Apart from the *Mary Kathleen*, *Counter*, *Skal* and *Elaine Dorothy*, the deposits have not been extensively tested at depth. The *Mary Kathleen* is the only deposit with proved ore reserves exceeding one million tons and the *Counter* and *Skal* are the only other deposits with reserves of more than 250,000 tons. There are at least 14 deposits which might contribute smaller quantities of ore if a local market becomes available.

PART I.—HISTORY, GENERAL GEOLOGY AND RESOURCES

INTRODUCTION

The object of this paper is to give a concise but comprehensive account of the uranium deposits of North-Western Queensland. All the reliable information available at the Geological Survey of Queensland has been used, in addition to the writer's field notes compiled during intermittent field work totalling 11 months between 1954 and 1959. The sources of information referred to are mentioned in the Acknowledgements.

Location

The uranium deposits of North-Western Queensland are confined to part of the Precambrian which crops out in a region extending from the Northern Territory border near latitude 17 deg. S. to near latitude 22 deg. S., south of which the Precambrian is overlain by Cambrian and younger sedimentary rocks. The outcrop area of the Precambrian is elongated in a north-north-west direction and extends in Queensland over a length of nearly 400 miles and an average width of roughly 60 miles.

Topography

The topography of the Precambrian is marked by the occurrence of groups of low, rugged hills which usually rise 200 to 400 feet above the surrounding country. Many groups of hills are elongated parallel to the north to north-north-westerly regional strike and are commonly composed of quartzites, metamorphosed acid volcanics and igneous complexes. The intervening valleys are commonly underlain by metamorphosed argillaceous and calcareous sediments and basic volcanics.

The Selwyn divide which separates the inland from the coastal river system, occurs towards the southern limit of the Precambrian. The elevation of the divide ranges from 1,000 to 1,500 feet. South of the divide the streams drain towards Lake Eyre and the coastal rivers drain north into the Gulf of Carpentaria.

Climate, Vegetation and Water Supply

The region lies wholly within the tropics. For the most part the climate is semi-arid, merging to sub-humid

in the extreme north of the region. The rainfall ranges from 17 inches at Cloncurry which is typical of the Cloncurry–Mount Isa area in the south, to 27 inches at Burketown which is typical of the Westmoreland area in the north. More than 80 per cent. of this rain falls in the monsoonal " wet " season from November to March. The mean maximum temperature at Cloncurry ranges from 100·4 deg. in December to 76·4 deg. in July but the mean humidity is low (18 to 34 per cent.).

The vegetation over much of the region consists of spinifex grass and stunted species of eucalypt, bauhinia and acacia trees and shrubs. Flinders and Mitchell grasses occur on the river flats and tall gums and ti-tree along the main river channels. North of the 19 deg. S. parallel pandanus and cabbage palms occur long the permanent, spring-fed streams.

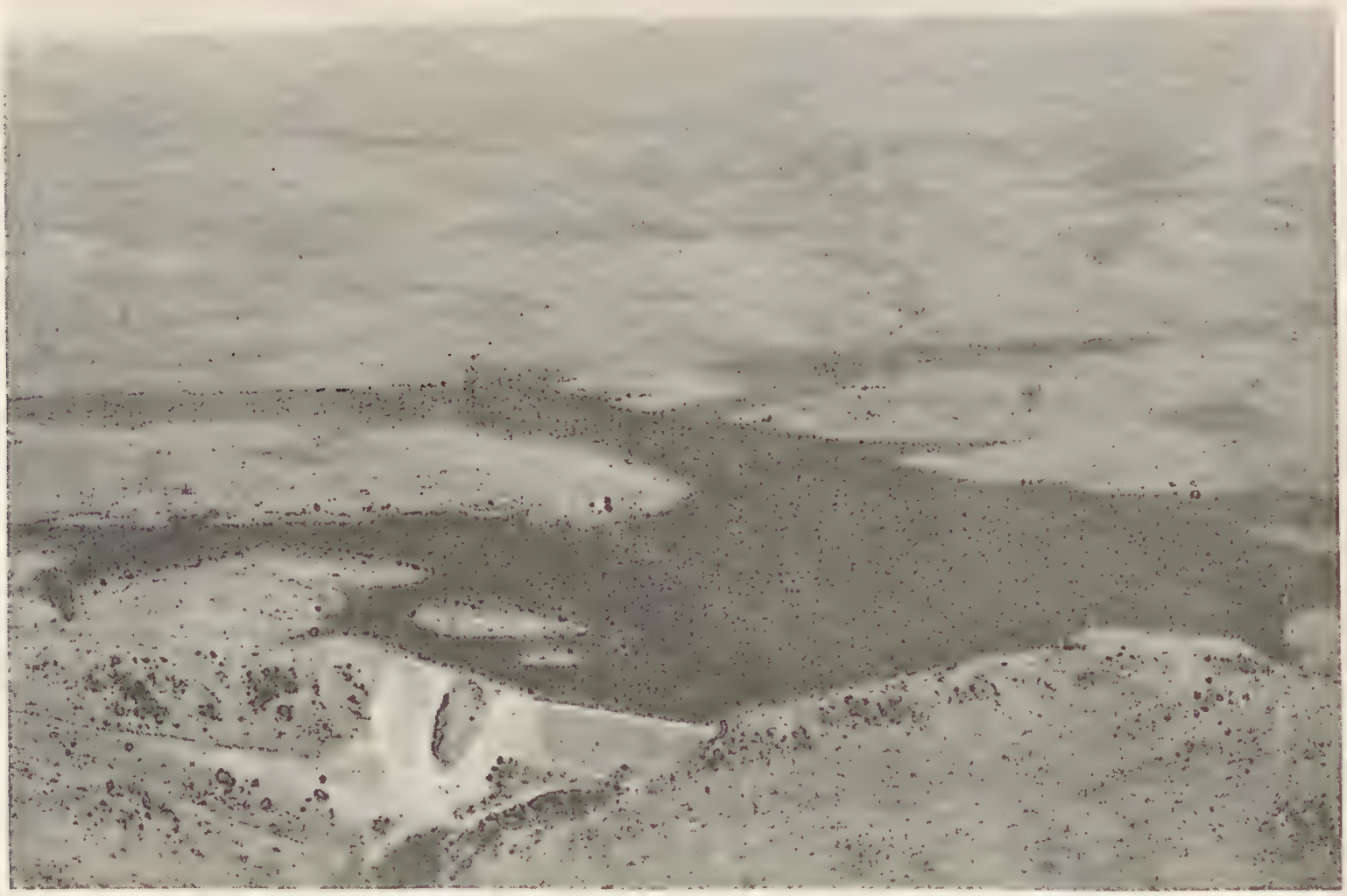
With the exception of these spring-fed streams in the Lawn Hill area there are no permanently-flowing water courses in the region. Mount Isa and Mary Kathleen obtain an ample water supply from dams across the Leichhardt and Corella Rivers, respectively. Until recently Mount Isa was dependent on the small Rifle Creek dam and a series of bores along the Leichhardt River for its water requirements. Cloncurry obtains a rather inadequate water supply from bores along the Cloncurry River. Elsewhere water is obtained from earth tanks, permanent and semi-permanent water holes and sub-artesian bores.

Population, Communications and Industries

At the 1954 census the population of the Cloncurry–Mount Isa district was 10,512. The population is largely centred in the towns of Mount Isa (7,432) and Cloncurry (1,955). The population of Mount Isa has continued to increase since 1954 and the new town of Mary Kathleen has a population of 1,200.

Cloncurry is 481 miles, and Mount Isa 603 miles, by railway from the port of Townsville. Both these towns have commercial airfields and are connected with Brisbane and the Southern States by daily air services. Mary Kathleen has a landing strip for light aircraft as have several of the cattle stations in the area. The only sealed surface roads are the Barkly Highway which connects Mount Isa with the Northern Territory, and the 40-mile stretch between Cloncurry and Mary Kathleen. Other roads become impassable following heavy rain.

Mining and cattle-raising are the industries of the region. Up to 1957 the Cloncurry–Mount Isa Mineral Fields have produced 264,622 tons of copper, 860,711 tons of lead, 67,064,301oz. of silver, 422,090 tons of zinc and some gold and cobalt. The mining of silver-lead-zinc and copper at Mount Isa was the only major mining industry at the time of the discovery of uranium.



Aerial view of the Corella dam which provides the water supply for Mary Kathleen.

[*Photo. by " Courier-Mail ".*

Aerial view of Mary Kathleen township, 1958.

[*Photo. by "Courier-Mail".*

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The assistance given by Mr. D. Ostle, Senior Geologist, of the United Kingdom Geological Survey, Mr. E. K. Carter, Senior Geologist and Mr. B. P. Walpole, Supervising Geologist, both of the Commonwealth Bureau of Mineral Resources, and Mr. D. S. Carruthers, Assistant Geologist of the Geological Survey of Queensland, who accompanied me at various times on field inspections was greatly appreciated. Geologists of mining and exploration companies co-operated readily during inspections of their leases. Companies which provided data used in this paper include Mount Isa Mines Ltd., Rio Tinto Australian Exploration Pty. Ltd., Australasian Oil Exploration Ltd., Mary Kathleen Uranium Ltd., Queensland Mines Ltd., United Uranium N.L., Mineral Ventures N.L., Gold Mines of Australia Ltd., Mining Corporation (Australia) N.L., Uranium Search Pty. Ltd., and Isa Uranium Syndicate N.L. Information was also obtained from unpublished reports to the Chief Government Geologist, Geological Survey of Queensland, by T. H. Connah, District Geologist, K. R. Levingston, Geologist, and D. S. Carruthers, Assistant Geologist. Research organizations which have contributed to the knowledge of the mineralogy of the uranium deposits include the South Australian Department of Mines, the University of Queensland Department of Mining Engineering, the Commonwealth Scientific and Industrial Research Organization, the Commonwealth Bureau of Mineral Resources, the New South Wales University of Technology Department of Mining, the United Kingdom Atomic Energy Authority and the Geological Survey of Queensland.

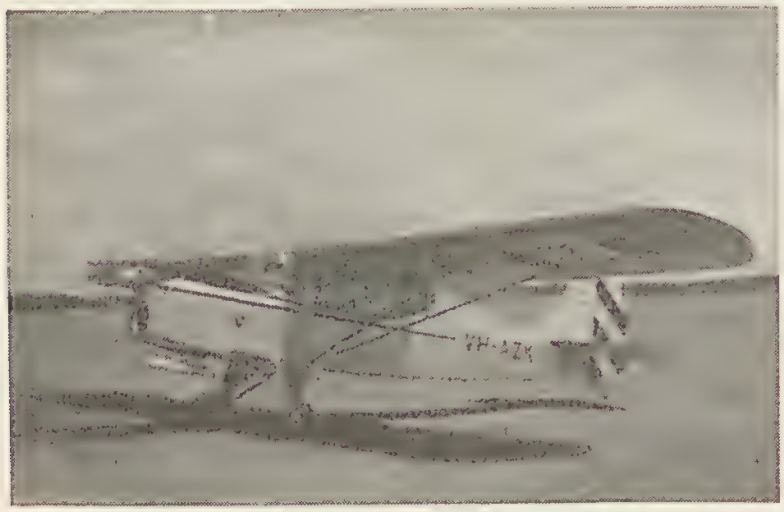
HISTORY OF EXPLORATION

Prior to the discovery of significant quantities of uranium at the *Skal* on 14th March, 1954, the search for uranium had been on a very limited scale and no overall coverage of the region had been attempted. Joint Bureau of Mineral Resources and Geological Survey of Queensland field parties carried out a regional geological survey of the Precambrian from 1950–1954 but no specific search for uranium was made. In view of the association of copper and cobalt with uranium in some other uranium provinces, it was expected that if uranium was present in quantity it would be associated, at least in part, with the copper and cobalt deposits of the Cloncurry–Mount Isa area. Accordingly, all known deposits of copper and cobalt were tested for radioactivity without any marked success. Subsequent intensive prospecting for uranium revealed only one occurrence of copper-uranium mineralization of any significance. This was on the long-forgotten *Monakoff* copper freehold.

The mining companies carrying out exploration in the Cloncurry and Mount Isa Mineral Fields in the 1953–54 period were Mount Isa Mines Ltd., Titanium Alloy Manufacturing Co. Pty. Ltd. (a subsidiary for the National Lead Co. of U.S.A.) and Mines Exploration Pty. Ltd. (a subsidiary of Broken Hill South Ltd.). These companies were primarily concerned in the discovery of copper and silver-lead-zinc deposits. The private miners and prospectors were largely preoccupied with the "gouging" of copper ore for which a high price was ruling at the time.

The discovery of the first uranium deposit was made by a party of "week-end" prospectors headed by Birger Schildt. This party was prospecting for copper but they carried a geiger counter and made tests for radioactivity concurrently. The *Skal* was found half a mile south of the small *Royal George* copper workings, 20 miles north of Mount Isa.

Mount Isa Mines Ltd. geologists immediately followed up this find and several other deposits were located within a radius of a few miles of the original discovery. All these early discoveries were made in a similar type of sedimentary rock in the Eastern Creek Volcanics and as a basis for prospecting this Company decided to throughly prospect the Eastern Creek Volcanics as a whole. A scintillometer mounted in an



Auster aircraft, the type used extensively in the airborne exploration for radioactive deposits.

[Photo. by N. A. H. Simmonds.

Auster aircraft was used in conjunction with ground prospecting parties. This led to the discovery of many more deposits but though some of these were of considerable size (up to 250 tons per vertical foot) the grade was usually in the vicinity of 0·1 per cent. U_3O_8 or less. The Company extended its search over 5,027 square miles in the Eastern Creek Volcanics and its equivalents, the Marraba Volcanics and Soldiers Cap Formation. An airborne scintillometer survey was also made of the Mount Cobalt area and some of the Corella Formation was flown following the discovery of the *Mary Kathleen*. However, only small deposits of the davidite type were found.

Meanwhile scores of amateur and experienced prospectors, and prospecting teams organised by the mining companies, extended the search for uranium to all accessible parts of the region and the uranium "fever" was maintained till the onset of the wet season at the end of 1954. United Uranium N.L. and North Australia Uranium Corporation used airborne scintillometers in conjunction with ground parties and Australasian Oil Exploration Ltd., Gold Mines of Australia Ltd. and Uranium Search Pty. Ltd. were prominent in buying leases or obtaining options from prospectors.

In May, 1954, the *Counter* deposit, 9 miles north-east of Mount Isa, was discovered by Anderson and party, and on 6th July, 1954, the Walton–McConachy prospecting party discovered the *Mary Kathleen*. It was soon realised that this was the most promising uranium deposit discovered to that time and that it held a possibility of being large enough to justify the erection of a treatment plant. Several mining companies negotiated with the Walton party for the purchase of the leases which were finally sold to Australasian Oil Oil Exploration Ltd. for £250,000 in cash, a 20 per cent. share interest in the Company (face value £250,000) and 5 per cent. of the gross proceeds of the ore mined. No developmental work had been done on the deposit at this time and most negotiating companies based their assessment of the deposit on a very limited number of surface samples. Subsequent systematic costeaning and diamond drilling justified the early confidence of the geologists of Australasian Oil Exploration Ltd. in the potential of the *Mary Kathleen*.

Late in 1954 Mineral Ventures N.L. and Metals Exploration N.L. became prominent in uranium exploration but none of the prospects tested by these companies proved to be worth developing. Early in 1955, Rio Tinto Co. Ltd. London, through its wholly owned subsidiary, Rio Tinto Mining Co. of Australia Pty. Ltd., negotiated a controlling interest in Mary Kathleen Uranium Ltd., the company formed to develop the *Mary Kathleen* deposit. An extensive programme of diamond drilling was then undertaken with the objective of proving sufficient reserves to justify the erection of a treatment plant. This objective was reached in February, 1956, and an agreement for the sale of £40 million worth of uranium oxide to the United Kingdom Atomic Energy Authority was concluded. Work then commenced on the erection of the town, water-storage dam and treatment plant. Open-cut mining commenced in October, 1956, and the ore was stockpiled till the completion of the treatment plant in June, 1958.

Exploration camp, Mary Kathleen, 1956.

Many claims for rewards were made under the Commonwealth Government's offer of a maximum of £25,000 for the discovery of uranium. Rewards paid for North-Western Queensland discoveries were *Mary Kathleen* (£25,000), *Skal* (£500), *Milo* (£500), *Counter* (£200), *Tinboll* (£200), *Helafells* (£100), *Eldorado–Easter Egg* (£50), *Duke* (£50) and *Ballara* (£50). With the exception of the *Mary Kathleen* the rewards were paid very largely on the discovery value of the deposits. The full £25,000 was paid in the case of the *Mary*

Outcrop of Mary Kathleen deposit, 1954.

Exploration of the Mary Kathleen deposit by costeaning, 1954.

[*Photo by L. Thiess.*

Exploration of the Mary Kathleen deposit by diamond drilling, 1955.

Kathleen when its extent had been determined by diamond drilling and a decision to develop the deposit had been made. In the majority of cases the purchase or option prices paid by mining companies to the discoverers for the leases far exceeded the rewards granted but the existence of a reward offer did give an added incentive to prospecting particularly in the early stages before the large number of mining companies were attracted to the area.

Apart from the Mary Kathleen area the tempo of prospecting declined rapidly in 1955 and remained at a low level until 1959 when Queensland Mines Ltd. commenced an extensive programme of diamond drilling at the *Counter* and *Skal* leases. In the Mount Isa area many leases which had lapsed were taken up again as there were prospects that a treatment plant would eventually be erected and would treat custom ore in addition to ore from the *Counter* and *Skal* deposits.

As a result of an airborne scintillometer survey of the Westmoreland area in 1956 by the Commonwealth Bureau of Mineral Resources, uranium mineralization was found at five localities by Mount Isa Mines Ltd. One of these occurrences, known as the *Redtree*, warranted detailed exploration. In the 1958–59 period an airborne scintillometer survey was made over much of the outcrop area of the Eastern Creek Volcanics, using an Auster aircraft. This did not result in the detection of new radioactive anomalies of any economic significance.

In 1957 Rio Tinto Finance and Exploration Ltd. carried out a helicopter–scintillometer survey of the Corella Formation. The survey covered an area of 3,200 square miles but no significant deposits were found. This Company has also carried out an intense search in the Corella Formation within a radius of several miles of the *Mary Kathleen* deposit without any marked success.

To summarise the history of discovery of uranium in North-Western Queensland it may be said that airborne scintillometer surveys by low-flying, light aircraft have been responsible for the location of several deposits worthy ofdetailed investigation but that all the more important discoveries have been made by private prospecting parties and can be attributed to their thoroughness and persistence and in some cases to their good fortune.

REGIONAL GEOLOGY

Only a brief summary of the regional geology will be given here. For a detailed description reference may be made to Carter *et al.* (in press).

The Precambrian of North-Western Queensland is situated along the north-eastern margin of the Australia Precambrian Shield. The greater part of the succession is assigned to the Lower Proterozoic. The extent of the Archaean is somewhat uncertain but the formations at present referred to this era are restricted in outcrop area. The mineralized Upper Proterozoic is developed principally in the northern part of the region

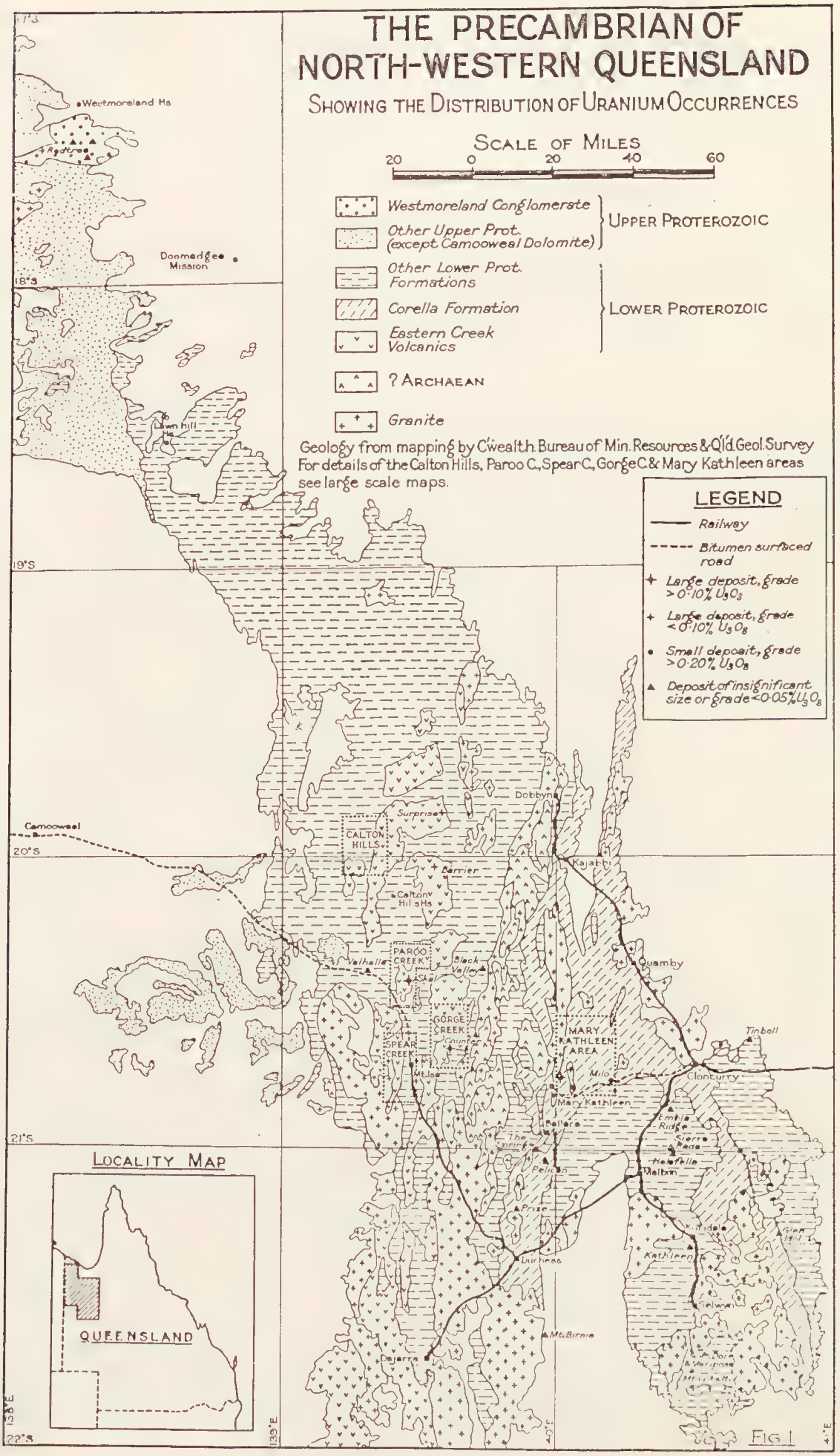

THE PRECAMBRIAN OF NORTH-WESTERN QUEENSLAND
SHOWING THE DISTRIBUTION OF URANIUM OCCURRENCES
SCALE OF MILES
20 0 20 40 60
Westmoreland Conglomerate
Other Upper Prot. (except Camooweal Dolomite)
UPPER PROTEROZOIC
Other Lower Prot. Formations
Corella Formation
Eastern Creek Volcanics
LOWER PROTEROZOIC
? ARCHAEAN
Granite
Geology from mapping by C'wealth. Bureau of Min. Resources & Q'ld. Geol. Survey
For details of the Calton Hills, Paroo C., Spear C., Gorge C. & Mary Kathleen areas see large scale maps.
LEGEND
Railway
Bitumen surfaced road
Large deposit, grade >0·10% U_3O_8
Large deposit, grade <0·10% U_3O_8
Small deposit, grade >0·20% U_3O_8
Deposit of insignificant size or grade <0·05% U_3O_8
Westmoreland Hs
Doomadgee Mission
Lawn hill
Camooweal
CALTON HILLS
Surprise
Carrier
Calton Hill s Hs
PAROO CREEK
Valhalla
Black Valley
Skal
GORGE CREEK
Country
SPEAR CREEK
Mt Isa
MARY KATHLEEN AREA
Milo
Dobbyn
Kajabbi
Quamby
Tinbell
Cloncurry
Mary Kathleen
Ballara
The Spring
Pelican
Prize
Duchess
Mt Birnie
Ebenezer
Kathleen
Selwyn
Ernie Ridge
Sierra Nevada
Mokofella
Dalton
Glen Idol
LOCALITY MAP
QUEENSLAND
18°S
19°S
20°S
21°S
22°S
138°E
139°E
140°E
141°E

FIG 1

C

near the Northern Territory border (see Fig. 1). A programme of granite sampling for absolute age determinations by the Commonwealth Bureau of Mineral Resources may result in the removal of much of the uncertainty which exists regarding the assignment of formations to divisions of the Precambrian.

Archaean

Migmatite, gneiss, mica schist, recrystallized acid lavas and amphibolite of the Leichhardt and Yaringa Metamorphics are tentatively assigned to the Archaeozoic. These formations are largely devoid of mineral deposits although some small copper deposits occur in rocks included in the Leichhardt Metamorphics.

Lower Proterozoic

There are three broad divisions of Lower Proterozoic formations and for convenience these will be referred to as lower, middle and upper divisions. At the base of the lower division there is a development of acid lavas with some basalt and sediments. Above the acid lava succession there is an extensive development of basic lavas with interbedded sediments (principally quartzites). The pene-contemporaneous Eastern Creek Volcanics, Marraba Volcanics and Soldiers Cap Formation are included in this sequence. Important deposits of copper, uranium and gold occur in these formations. The sediments and lavas were laid down in two northerly trending geosynclinal troughs and crop out extensively over a length of 200 miles in the southern portion of the Precambrian.

The formations of the lower division of the Lower Proterozoic were affected by a minor orogeny and were followed by a sequence of calcareous and arenaceous sediments with minor basic volcanics. The principal formations are the Corella Formation, Judenan Beds, Myally Beds, Marimo Slate and Kuridala Formation. These were subjected to strong folding on meridional axes and were extensively faulted. Overthrusting occurred near the western and eastern margins of the depositional area. Granite intrusion may have accompanied the orogeny. There is a wide range of metamorphism in the lower and middle divisions of the Lower Proterozoic but, in general, it is low to moderate, with local areas of high grade metamorphism. Important uranium, copper-gold, cobalt and silver-lead-zinc deposits occur in the Corella and Kuridala Formations and the Marimo Slate.

The upper division of the Lower Proterozoic consists of shale and dolomite with some siltstone, sandstone and greywacke. The sedimentation took place mainly along the north-western and western margin of the main depositional area. Only minor volcanics occur in the succession. The principal formations are the Mount Isa Shale, the Lawn Hill Formation, Surprise Creek Beds, and the Paradise Creek and Gunpowder Creek Formations. These formations contain important copper and silver-lead-zinc deposits but no significant uranium deposits. Metamorphism is slight compared with that in the middle and lower divisions of the Lower Proterozoic. A major orogeny with folding and faulting and the extensive intrusion of granite took place towards the close of the Lower Proterozoic. The folding was in part on meridional axes. However, to the north-west of the geosynclinal area deposition took place in a shelf environment and here the sediments have been folded into gently-dipping, basin-dome structures without strong linear trends. It is considered that silver-lead-zinc, copper, cobalt and gold mineralization accompanied this orogeny and the associated granite intrusions.

Upper Proterozoic

The most important deposition in the Upper Proterozoic was in the Westmoreland–Lawn Hill area. There were three cycles of acid to intermediate vulcanicity and in the intervening periods of sedimentation dolomite, siltstone, sandstone, conglomerate, arkose and greywacke were deposited. These were laid down in an east-west trending depositional area north of the Nicholson River and extending into the Northern Territory. The associated shelf deposits, consisting of sandstone, siltstone and shale, occur to the south of the Nicholson River. Sedimentary iron deposits occur in the Mullera Formation south of the Nicholson River and relatively minor deposits of uranium, tin and copper occur in the sedimentary and volcanic formations to the north. A minor unconformity with an associated granite intrusion occurs near the base of the geosynclinal succession. The Upper Proterozoic in this area has been gently folded and faulted, but is unmetamorphosed.

There are other formations unconformably overlying the Lower Proterozoic succession which belong to the Upper Proterozoic or Lower Cambrian. No description of them will be given here as they are practically devoid of mineral deposits. The occurrence of a weakly-uraniferous cap rock on the Lower Cambrian Birnie Arkose is of some mineralogical interest.

Igneous Intrusions

Seven major outcropping areas of granite occur in the Lower Proterozoic geosynclinal areas. The dominant type is a coarse-grained, porphyritic, microcline-biotite granite which is commonly somewhat gneissose. A less extensive, later phase, microcline-biotite granite is fine to medium-grained and of even texture. Small, widely separated intrusions of albitite and sodic granite also occur. Uranium minerals have been found associated with derivatives of all but one of the seven major granite intrusions. The association is usually with pegmatite dyke swarms as at Mica Creek, south-west of Mount Isa, and at Florence Creek north-east of Kuridala on the Selwyn branch railway line.

The Nicholson Granite in the Westmoreland area is a red, massive, even-grained to porphyritic, microcline granite. It is probably genetically related to the earliest cycle of acid volcanics in the Upper Proterozoic succession.

At least three cycles of basic intrusion occurred during the Proterozoic. Numerous dykes of the first cycle intrude the basal acid lava sequence and these dykes have been metamorphosed to varying degrees. They are probably related to the extensive development of basic volcanics in the Eastern Creek volcanics and its equivalents. A second cycle intrudes formations

TABLE 1—DATA ON FORMATIONS IN WHICH URANIUM OCCURRENCES HAVE BEEN FOUND
(Stratigraphic nomenclature as defined by Carter *et. al.* (in press)).

Formation	Division	Lithology	Distribution	No. of U. Occurrences	Remarks
Birnie Arkose	Lower Cambrian ..	Arkose, arkosic and shaly sandstone	Crops out discontinuously over a distance of 25 miles in a narrow meridional belt from the Malbon–Duchess road southwards	3	Ferruginous cap rock is weakly uraniferous. The deposits are of no economic significance
Westmoreland Conglomerate	Upper Proterozoic	Conglomerate, coarse sandstone, arkose	From Northern Territory border SW. of Westmoreland homestead for 30 miles easterly over a width of 1 to 12 miles. Part of geosynclinal sedimentation which extended into the Northern Territory	5	Deposits of secondary U. minerals occur in horizons of coarse sandstone. The only important occurrences later than the Lower Proterozoic
Surprise Creek Beds	Lower Proterozoic	Sandstone, siltstone, quartzite, dolomite, conglomerate	In a meridional belt extending for 90 miles north of the Cloncurry–Mount Isa road from 11 miles E. of Mount Isa	4	U. occurs in highly ferruginous, arenaceous sedimentary rocks. They are probably superficial concentrations
Judenan Beds	Lower Proterozoic	Quartzite, argillaceous sandstone, siltstone shale and a few thin basalt flows	In a narrow meridional belt from 80 miles north of Mount Isa to 30 miles SSW. Adjacent to Eastern Creek Formation on the west for the most part	2	The main occurrence is a low grade torbernite deposit in shales
Kuridala ..	Lower Proterozoic	Carbonaceous slate, mica schist, quartzite. Amphibolite dykes and sills	In a meridional belt with a maximum width of 19 miles from 22 miles N. to 38 miles S. of Selwyn	5	This formation has important Cu and Co deposits in it. The small U. occurrences have Cu associated with them
Marimo Slate	Lower Proterozoic	Interbedded arenaceous slate, quartzite and quartz siltstone	South of Cloncurry in a meridional belt 28 miles long and 11 miles wide. More or less contemporaneous with the Corella, Kuridala and Staveley Formations	8	U. occurs in ferruginous beds of arenaceous or argillaceous type. The deposits are very low grade
Corella ..	Lower Proterozoic	Calc-silicate granulite, gneiss and hornfels (recrystallized impure limestones and dolomites). Some interbedded quartzite metabasalt, calc-breccia and slate	Crops out extensively over a meridional length of 170 miles in the eastern geosynclinal area from 108 miles N. of Mary Kathleen to 70 miles south	40	Includes *Mary Kathleen* and *Milo*. Most of the other occurrences are of the davidite-type, usually with pegmatitic associations
Soldier's Cap	Lower Proterozoic	Mica, garnet, andalusite schist, quartzite, metabasalt and slate	Confined to an area on the SE. margin of the outcropping Precambrian E. and SE. of Cloncurry. Equivalent in part to the Eastern Creek Volcanics	3	U. occurs in ferruginous arenites. The formation has small Au—Cu deposits and only important U. deposit is the *Monakoff* (*Tinboll*) where U. is associated with Cu
Eastern Creek Volcanics	Lower Proterozoic	Meta-basalt with interbedded quartzite, slate and altered limestone	Crops out extensively over a meridional distance of 175 miles from 83 miles N. to 92 miles SSW. of Mount Isa. Occurs over most of the western section of the geosynclinal area	91	Includes *Counter*, *Skal*, *Queen's Gift*, *Duke*, *Easter Egg* and numerous low grade deposits. U. is usually in arenaceous or calcareous metasediments but it has also been found in the metabasalt
Granitic Rocks	Lower Proterozoic	Pegmatite, aplite, hybrid granite	Six major intrusions of granite which usually crop out in meridional belts	18	The refractory minerals davidite, brannerite and absite have been found in these occurrences. None is of economic significance

overlying the Eastern Creek volcanics but is earlier than the major granite intrusion at the top of the Lower Proterozoic. A third cycle of relatively unaltered dolerites intrudes the major bodies of granite.

Faulting

As a result of the orogenies which affected the Lower Proterozoic formations they have been extensively faulted. High angle overthrust faulting and strike faulting took place along meridional or north-north-westerly striking planes. The best example of overthrusting from the west is the Mount Isa Shear which occurs between the Judenan Beds and the Mount Isa Shale just west of Mount Isa. The Cloncurry Shear along which the Soldier's Cap Formation is upthrust against the Corella Formation is an example of overthrusting from the east. Compressional faulting also took place along north-easterly and north-westerly striking complementary fault planes. The north-easterly striking faults are very prominent and individual faults of this type can be traced for distances of up to 30 miles. The horizontal displacement can sometimes be measured in miles. Post-granite movement has taken place in some cases. Block faulting is fairly widespread in the Eastern Creek Volcanics and adjacent sedimentary formations. Tension faulting along roughly east-west planes is of common occurrence in some areas. The resistance to weathering of the quartz introduced along many of the fault planes facilitates their delineation. Faulting is also widespread in the Upper Proterozoic but the displacement is usually small.

DISTRIBUTION

Nearly all the recorded occurrences of uranium are distributed in a north-north-westerly trending belt 130 miles long and 85 miles wide extending from 15 miles east of Cloncurry to 7 miles west of Mount Isa, and from Eastern Creek, 60 miles north of Mount Isa, to Dajarra and Mount Cobalt in the South. This is the southern section of the Precambrian of North-Western Queensland (see Fig. 1). The northern section is devoid of known deposits except for the Westmoreland Conglomerate deposits which occur in the extreme north near the Northern Territory border. However, small pitchblende deposits occur a short distance across the Northern Territory border from the Westmoreland area.

With few exceptions the uranium occurrences are confined to seven formations in the lower and middle divisions of the Lower Proterozoic. Over seventy per cent. of the deposits occur in two formations, the Eastern Creek Volcanics (51 per cent.) and the Corella Formation (22 per cent.). There are few deposits of any importance in the other five formations (see Table 1). The restriction of the majority of uranium deposits to two Lower Proterozoic formations indicates the importance of stratigraphic distribution in the exploration for uranium deposits. However, when considering the genetic implications it must be remembered that these two formations crop out over far more extensive areas in the strongly mineralized section of the Precambrian than any of the other 26 Lower Proterozoic formations recognized by Carter *et al.* (in press) and that 10 of the 21 non-uraniferous formations do not contain mineralization of any kind. The Corella Formation crops out over an area of nearly 2,000 square miles and the Eastern Creek Volcanics over an area of more than 1,500 square miles.

The uranium occurrences are not as extensively distributed areally or stratigraphically as the copper deposits of the Cloncurry-Mount Isa mineral province (fifteen of the 28 Lower Proterozoic formations contain copper deposits of some significance). Minor amounts of copper are commonly associated with the uranium occurrences but it is uncommon to find even minor amounts of uranium in the copper and other base metal deposits of the region. The exceptions are the small *Monakoff* and *Mount Dore* copper deposits and the *Mount Cobalt* cobalt-copper deposit. The grouping of the uranium deposits in no way reflects the grouping of the copper and other metalliferous deposits. No uranium deposits have been found in the isolated Lawn Hill silver-lead field (Burketown Mineral Field). The Eastern Creek Volcanics in which numerous uranium deposits occur, contain none of the important copper, silver-lead-zinc, gold, and cobalt deposits of the Precambrian mineral belt. However, important copper deposits and minor silver-lead-zinc, gold and cobalt deposits occur within the Corella Formation in addition to the important *Mary Kathleen* deposit and numerous minor uranium deposits. The Mount Isa Shale and the Argylla, Gunpowder Creek, and Kuridala Formations which have important base metal deposits have only a few, unimportant uranium deposits.

From the virtual absence of uranium mineralization in the formations deposited late in the Lower Proterozoic (including the Mount Isa Shale) it is inferred that uranium mineralization in the Cloncurry-Mount Isa mineral province probably took place earlier than the main silver-lead-zinc-copper mineralization. It may have been associated with the minor orogeny and granite intrusion which is thought to have followed the deposition of the Judenan Beds and Corella Formation. The Westmoreland uranium deposits are of Upper Proterozoic age and occur in a mineral province of relatively minor importance which extends from the Westmoreland area to the Wollogorang and Macarthur River areas of the Northern Territory.

The only occurrences of uranium in Post-Precambrian formations are minor ones in the Lower Cambrian Birnie Arkose and the Lower Cretaceous Toolebuc Member of the Wilgunya Formation. A yellowish-green uranium mineral occurs in association with fossil fish remains in the Toolebuc Member of the Wilgunya Formation (Casey *et al.*, 1960).

Uranium mineralization has been found in a wide range of lithological types, including hematitic and calcareous quartzite, sandstone, and siltstone, calcareous granulite, recrystallized limestone, magnetite greywacke, meta-basalt, allanite and hornblende schist, slate, shale and a variety of granitic rocks. Deposits are absent from the massive quartzites, and the altered acid volcanics, and are of infrequent occurrence in the dolomitic, carbonaceous and graphitic shales and slates which are by far the most important host rocks for the copper and silver-lead-zinc deposits of the

Precambrian mineral belt. In addition to the small deposits associated with pegmatites and other granitic rocks, the granites as a whole commonly exhibit two to five times background radioactivity (Geiger-counter readings).

MINERALOGY

The mineralogy of the uranium deposits is quite complex and although a considerable amount of research has been carried out on the ores, the mineralogy, in many cases, has not been fully resolved. The *Mary Kathleen* and *Counter* ores are the only ones to have been subjected to an intense study. Identification of uranium minerals has been made for 50 of the deposits described, but in several instances positive identification could not be made and sometimes mineragraphic reports from different sources have given conflicting results. This can be attributed largely to the very fine grain-size of the primary uranium mineral in many of the ores.

Secondary Minerals

With the exception of the deposits in the Westmoreland Conglomerate and the *Milo* deposit, there are no significant concentrations of secondary uranium minerals. Small amounts of secondary uranium minerals occur in most of the deposits as thin films on joint and fracture planes to a shallow depth. Quite often primary ore minerals are present at the surface and exhibit only superficial alteration. The absence of spectacular occurrences of secondary uranium minerals at the surface probably has a bearing on the fact that the discovery of significant uranium deposits in Queensland came much later than the initial discoveries in South Australia and the Northern Territory.

Meta-Torbernite.—This mineral is of common occurrence in deposits in the Cloncurry-Mount Cobalt area and is also present in the Westmoreland deposits. It is recorded from a total of 16 localities. The most interesting occurrence is at the *Milo* where a lens of meta-torbernite ore containing 80 tons per vertical foot occurs in a white clay rock which is the end product of the weathering of an acid igneous rock or possibly a felspathic calc-silicate rock. In the deposits in the Westmoreland Conglomerate meta-torbernite occurs as disseminated, interstitial grains in a coarse, felspathic sandstone. A small quantity of meta-torbernite is associated with cobalt-copper-tungsten mineralization at the *Mount Cobalt* deposit, and at the *Monakoff* deposit it is associated with copper carbonates, hematite, fluorite, barytes and garnet.

Small quantities of uranophane have been identified in the *Mary Kathleen*, *Pelican*, *Counter* and *Clear Waters* deposits and it is likely that the unidentified, yellow uranium mineral commonly seen on joint and fracture planes in other deposits is also uranophane in a number of cases. Carnotite is of somewhat less frequent occurrence than uranophane but it has been identified at the *Easter Egg*, *Skal*, *Pile* and *Rosie Bee* deposits and it is present in some quantity in the *Redtree* deposit, Westmoreland. In the davidite-brannerite type of deposit in the Cameron-Corella River area there is a commonly-occurring, yellow alteration product around the primary mineral and this may be carnotite. Other secondary uranium minerals identified are gummite, beta-uranotil, autunite, saleeite (?), renardite, soddyite, zeunerite, and phosphuranylite.

Primary Uranium Minerals

Uraninite, davidite, brannerite and absite occur in that order of abundance. Uraniferous magnetite, ilmenite and columbite have also been identified. The uraninite and some of the brannerite are finely disseminated through the host rock and cannot be identified in the hand specimen. The davidite, absite and the remainder of the brannerite occur as medium to coarse-grained blebs or crystal pseudomorphs. Detrital grains of these minerals are usually present in the soil in the vicinity of the lode material.

Uraninite.—The principal occurrence of this mineral is at the *Mary Kathleen* where aggregates of fine grains are included in allanite and to a lesser extent in the rare-earth minerals stillwellite (a boro-silicate of the lanthanons), caryocerite (complex hydrated borosilicate of calcium and rare-earth minerals) and rinkite (silicate of iron, titanium, sodium, calcium and cerium) (Whittle, 1955b). The allanite itself is practically non-uraniferous. Some uraninite is associated with pyrrhotite, pyrite and chalcopyrite which occur as irregular bodies in the *Mary Kathleen* deposit. Uraninite has also been identified from the *Flat Tyre*, *Clear Waters* and *Janelle* deposits and doubtfully from the *Elaine Dorothy*, *Easter Egg* and *Tinboll* (*Monakoff*) deposits. At the *Flat Tyre* the uraninite occurs as aggregate of very fine grains. At the *Monakoff* minute inclusions which are thought to be uraninite occur in fluorite (Campbell *et al.* 1955 unpub.).

Brannerite is present as finely disseminated grains in a calcareous, hematitic siltstone at the *Skal* and *Pile* deposits (McAndrew and Edwards, 1954 a and b). Isolated crystals of brannerite occur in a mica schist adjacent to pegmatite at the *Comfort* deposit (Lawrence, 1955). Absite, the thoria-rich variety of brannerite (Whittle, 1954) has been found in small quantities at the *Doris Norelle*, *Three Inkspots*, *Why Not–Gumbardo* and *Lady Rachel* deposits in the Cameron River-Corella River and Ballara areas, and also between Mica Creek and Sybella Creek, south-south-west of Mount Isa. The occurrences consist of small pockets of granitic rock containing grains of absite. The granitic rocks include pegmatite, greisen, aplite and graphic granite.

A large number of occurrences of davidite-type mineral are known but most are only of mineralogical interest. Isolated occurrences are known in such widely separated localities as Kuridala, on the Selwyn branch railway line, Quamby, on the Dobbyn branch railway line and Dajarra in the far south of the region. However, most of the davidite-type mineral occurrences are in pegmatite or calcareous meta-sediments in the Cameron River-Corella River and Ballara areas, the most important being on the *Three Brunettes* and *Six Kangaroos* leases. As with the South Australian davidite, inclusions and intergrowths of ilmenite, rutile and hematite are common (Lawrence *et al.*, 1957). The ilmenite may also be uraniferous in some cases. The U_3O_8 content of davidite from different localities ranges from 2·17 per cent. to 20·16 per cent. It often

occurs as irregular to rounded blebs or shapeless masses but elsewhere a cuboidal form is exhibited. The lustre of the davidite increases from vitreous to metallic with an increasing amount of inclusions.

Specimens of uraniferous columbite have been obtained from a pegmatite in the *Mica Creek* area 6½ miles south-west of Mount Isa. Beryl and biotite have been mined in adjacent pegmatites. One specimen of columbite was found to contain 0·7 per cent. U_3O_8 (chemical analysis, Qld. Govt. Analyst).

The primary uranium mineral in many of the deposits in the Eastern Creek Volcanics, and in the torbernite-ironstone type of deposit in the Cloncurry area, is closely associated with iron oxide minerals. Hematite is usually the iron mineral in outcrop but magnetite is the most common primary iron material. In several ores with uranium-iron associations which have been subjected to mineragraphic study, no discrete uranium mineral has been identified. Dallwitz and Roberts (1955 unpub.) have attributed the uranium contents of samples to the magnetite in such deposits as the *Impassable* and the *Elaine Mary*. Uranium was found to be intimately associated with octahedra of magnetite in a specimen of altered felspathic siltstone from the *Pile* submitted to the Geological Survey of Queensland. A study of a polished section did not reveal the presence of any inclusions or coatings which could account for the observed radioactivity.

The ore from the *Counter* deposit contains abundant euhedral grains of magnetite but here a very fine-grained uranium mineral is closely associated with biotite, sphene and rutile. Various attempts to identify the uranium mineral have given conflicting results. The uranium has been attributed variously to pitchblende, xenotime, a davidite-like mineral, an iron ore-uranium mixture and a mineral with some properties corresponding to uraninite. After a detailed study, McKeague and Hockin (1957 unpub.) concluded that the primary uranium mineral is a non-homogeneous, crystalline complex that may have resulted from the replacement and alteration of sphene. Its properties do not correspond with any known uranium mineral and it is estimated to contain 15 to 25 per cent. U_3O_8.

TYPES OF DEPOSIT

1. Mary Kathleen Type

The occurrence of this type of deposit is confined to a meridional belt of highly metamorphosed and metasomatized calcareous and arenaceous sediments, five miles long and two miles wide, situated between two major concordant intrusions of granite. The deposits are characterized by the presence of zones of intensely garnetized rocks and by the occurrence of uraninite principally as fine-grained inclusions in allanite and other rare earth minerals which have replaced the garnet. The deposits are highly irregular in outline and grade, and it is only at the *Mary Kathleen* where mineralization has been intense that a large deposit of economic grade has been found. Other zones of intense garnetization occur at the *Elaine Dorothy* and *Armstrong North* prospects but the associated uranium mineralization is weak and sporadic. The *Mary Kathleen* is regarded by Matheson and Searl (1956) as a pyrometasomatic type of deposit derived from a late-stage emanation from granite intrusion. No comparable deposits of this type in which uranium is the principal metal are known either within Australia or elsewhere.

2. Eastern Creek Type

All the deposits of this type are in the Eastern Creek Volcanics. Typically the ore-shoots are well-defined and individual deposits are located in a particular horizon in the Formation. The mineralized horizons show a considerable range in rock type and in degree of metamorphism. Where determined, the finely-disseminated primary uranium mineral has been found to be uraninite, brannerite or uraniferous magnetite. A noticeable feature is that in most cases introduced gangue minerals make up only a small proportion of the ore rock. The deposits are considered to be of the hydrothermal replacement type. Uranium mineralization was introduced along faults or shear zones and deposited in the adjacent favourable beds. However, a sedimentary origin with subsequent redistribution of the uranium may also be postulated. The following sub-types can be distinguished :—

(i.) **Skal type** deposits are confined to the Paroo Creek–Calton Hills area north of Mount Isa. The very fine-grained, primary uranium mineral occurs in arenaceous sediments which are interbedded with altered basalt. The sedimentary rock is usually a siltstone which has been carbonated and impregnated with iron oxide minerals. Brannerite has been identified at the *Skal* and *Pile* deposits. Other deposits of this type include the *Hopeful*, *Queen's Gift*, *Batman*, and *Duke*.

(ii.) **Counter type** deposits are confined to the Gorge Creek area north-east of Mount Isa. Finely disseminated uranium mineralization occurs in fine to medium-grained, meta-greywacke or quartzite. Magnetite or hematite is commonly present but calcite, if present, usually occurs in minor amounts. The *Counter* deposit is somewhat exceptional in being a comparatively regular, compact orebody of considerable size. The uranium mineral has not been identified but it is refractory in type. Other deposits of this type are usually long, narrow and irregular in width, and of low, erratic grade. These include the *Geiger*, *Carol*, *New Ring* and *Gorge* deposits.

(iii.) **Easter Egg type.** Finely disseminated uraninite occurs in horizons of hornblende, biotite, quartz and allanite schists. The schists crop out a few miles west of Mount Isa in a belt 12 miles long and 2 miles wide from the Mica Creek area in the south to the Spear Creek area in the north. The deposits usually consist of long, narrow orebodies of irregular width and grade. They are situated in a pronounced embayment in the margin of the major Sybella Granite. The Mica Creek pegmatites which have tin, tantalum, thorium and uranium minerals associated with them occur to the south in the same belt of schists and the uranium deposits may be closely related to late stage granitic

intrusions. The *Flat Tyre, Mother's Day, Eldorado, Folderoll, Nevercantell, Mighty Glare, Midnight* and *Perseverance* deposits are included in this sub-type.

(iv.) **Surprise type.** Deposits of this type are relatively few in number and occur in the Calton Hills–Paroo Creek area north of Mount Isa. Very little mineralogical work has been carried out on the ores but in some cases the uranium is attributed to uraniferous magnetite which occurs in altered basalt. The basalt has been carbonated, chloritized and albitized to varying degrees. Deposits in this sub-type are the *Surprise, Elaine Mary, Impassable, Barrier* and *Mount Rover.*

3. Torbernite–Ironstone or Monakoff Type

The deposits of this type are characterized by very low-grade, disseminated, primary uranium mineralization in massive siliceous ironstone or ferruginous sandstone, and the presence of small concentrations of a secondary mineral, usually torbernite, in the zone of weathering. Weak copper mineralization is commonly associated with the deposits, all of which are in an area extending from Cloncurry to Mount Cobalt near the southern limit of the Precambrian. Occurrences are located in the Soldier's Cap Formation, Corella Formation, and Marimo Slate. The primary uranium mineral has not been identified but it occurs in a very finely-divided state as inclusions in fluorite at the *Monakoff.* The limonitic jasper gossans often associated with the deposits are indicative of sulphide mineralization at depth. In individual deposits the uranium is usually confined to a particular sedimentary horizon or occurs along lithological contacts. The association of magnetite, chalcopyrite, garnet and fluorite in the *Monakoff* ore is taken to indicate moderate to high temperature, hydrothermal deposition.

In some deposits the association of uranium and iron oxides at the surface is probably due to a process of supergene concentration in which the uranium has become "fixed" by the iron oxides. In such cases no primary source of any economic significance can be expected.

4. Davidite Type

Numerous small deposits have been found containing refractory uranium minerals and of these, davidite is by far the most common. Usually the minerals are associated with pegmatite, aplite, greisen or other granitic rock-types. They exhibit the usual coarse-grained pegmatitic features with the erratic distribution of metallic mineral constitutents. In a number of cases the davidite-type mineral occurs in calcite-actinolite-felspar rocks of the Corella Formation which may be adjacent to the granitic rocks as at the *Three Brunettes* deposit, or it may occur in a recrystallized calcite lens as at the *Six Kangaroos* deposit. Some uranium-thorium mineral associations occur in the Mica Creek, Corella River–Cameron River and Ballara areas. Absite and monazite have been found in pegmatites and the adjacent meta-sediments.

5. Westmoreland Type

Deposits of secondary uranium minerals occur in horizons of coarse-grained, felspathic sandstone towards the top of the Westmoreland Conglomerate. Torbernite and carnotite are the main uranium minerals and these are present as pore-space fillings and coating mineral grains of the sandstone. Pitchblende veins have been found in the volcanic sequence which overlies the Westmoreland Conglomerate in deposits across the Northern Territory border from the Westmoreland area and this provides a possible source for the secondary uranium minerals. This supergene origin is considered more likely than that of sedimentary deposition with the sandstone. The *Redtree* is the only important deposit of this type which has been located.

6. Superficial Types

Fairly extensive, weakly uraniferous areas occur in the outcrop of the Birnie Arkose, south-south-east of Duchess. They are considered to be superficial concentrations in a cap-rock, and the origin of the uranium is uncertain. It may originally have been deposited with the arkose or derived from deposits in adjacent Lower Proterozoic formations. The *First Try, Mother's Hope* and *Mary Lou* occurrences are of this type.

Very weak uranium mineralization is associated with limonitic cappings in the Glenroy group of deposits north-north-east of Mount Isa. These deposits also appear to be superficial concentrations.

CONTROLS IN ORE LOCALIZATION

In only a small proportion of the uranium deposits described has any close study been made of the controls in ore localization. Usually the control can be attributed to a combination of factors and those mentioned here will, in most cases, be the most obvious ones.

The controls of uranium mineralization at the *Mary Kathleen* are favourable host rocks, structures (including faults, shears, and joints) and garnetization (Matheson and Searl, 1956). A group of calcareous granulite beds containing a "breccia-conglomerate" horizon forms the host rock. North-easterly and west-north-westerly faults and joints provided channel-ways for the extensive introduction of garnet which was followed by uranium-bearing hydrothermal solutions. These solutions were probably derived from the granitic magma which was intruded to the east of the deposit. Selective replacement of the calcareous granulite by the garnet took place and the garnet was replaced in turn by uraninite and allanite. Mineralization was confined on the east and west by north-north-westerly trending strike faults, and west-north-westerly faults influenced the southern and northern extent of deposition. Replacement has taken place to such an advanced stage within the orebody that the structures in the original meta-sediments have been extensively or completely obliterated. However, from the configuration of the individual lenses of ore it appears that mineralization took place along joint or fault planes and the adjacent garnetized granulite was replaced to varying degrees. A system of northerly trending joints which dip west at 40 deg. to 70 deg. seem to have been of particular importance in this regard.

In a large number of deposits it is concluded that the uranium mineralization was introduced along a

fault plane or shear zone and deposited in the most favourable adjacent rock type. Typical of these is the *Skal* where a large body of white lode quartz marks a prominent strike shear zone. The quartz is slightly radioactive in part but significant mineralization is confined to an adjacent calcite and hematite-bearing siltstone. The interbedded chloritized basalt is unmineralized.

At the *Counter* deposit there are east-west strike faults and north to north-north-east transgressive faults. One prominant east-west fault marks the hanging-wall of the orebody. A transgressive fault intersects the outcrop of the orebody towards the eastern limit and a dolerite dyke was intruded along this fault plane. Another north-north-easterly fault appears to control the western limit of the orebody. Uranium mineralization occurs in a lens of cross-bedded meta-greywacke and, as at the *Skal*, the interbedded chloritized basalt is unmineralized. The north-north-easterly faults may have been responsible for the introduction of uranium mineralization, as the small *Battery* and *Father's Day* deposits to the north and the *Geiger* deposit to the south of the *Counter*, occur in meta-sediments along roughly the same north-north-easterly trending line.

The *Pelican* deposit in the Ballara area is another example of the fault-favourable bed association in ore localization. A regional, quartz-filled strike fault occurs adjacent to the deposit on the east. The uranium mineralization is confined to crumpled beds of calc-silicate rocks and slate.

The shearing of incompetent rock types, sometimes with accompanying drag-folding has provided a favourable locus for uranium deposition in some localities. At the *Monakoff* (*Tinboll*) a bed of ferruginous sandstone which is interbedded with amphibolite has been sheared and drag-folded, and where this has been most intense, copper and uranium deposition has taken place. In the *Duke* group of deposits in the Calton Hills area, the meta-basalt—quartzite succession has been subjected to local shearing of considerable intensity. Small deposits of uranium occur in less competent quartzite and other meta-sediments which are extensively fractured. As a general rule altered basic volcanics are unfavourable host rocks but if they are highly fractured and altered, as at the *Surprise* deposit, uranium deposition may take place in them. A somewhat different control of ore localization is evident at the *Mother's Day No.* 3 deposit. Shearing, which resulted in intense fracturing on the nose of a small fold in amphibolite and chlorite schist, produced a favourable locus for uranium deposition. The higher grade ore is confined to the nose of the fold and the grade decreases as the beds are traced to the limbs of the fold.

The association of hematite and calcite with uranium is particularly noticeable in the deposits of the Paroo Creek–Calton Hills–Gorge Creek areas. In many cases the extent of the radioactive anomaly could be outlined by reference to the reddish coloration imparted to the rock by disseminated hematite. There appears to be a definite affinity between the iron and uranium minerals in such cases. Calcite may have acted as a precipitating agent for the uraniferous solutions. Petrological work by Dallwitz and Roberts (1954) indicates that the hematite and calcite represent introduced gangue minerals. The fact that they occur in altered basalts as well as meta-sediments supports this view.

In the deposit of secondary uranium minerals in the Westmoreland Conglomerate it is thought that joints and earthy bands between the sandstone beds acted as solution channels (Syvret, 1957). Iron and manganese oxide may have acted as precipitating agents for the uranium. No particular stratigraphic control was in evidence nor did the mineralization appear to be related to lithology, grain size or current bedding.

The broad stratigraphic control of the uranium deposits has been referred to in the section on Distribution and in Table 1. The lithological and structural controls of uranium mineralization bear little relation to those of the other metalliferous deposits of the region. For instance, the quartz-filled faults and shear zones with which so many of the copper deposits of the Cloncurry–Mount Isa area and the silver-lead deposits of the Lawn Hill area are associated, very rarely carry uranium mineralization. However, the main systems of compressional faulting are important controls in all the metalliferous deposits.

ORE GENESIS

The question of the mode of origin of the uranium deposits came into prominence soon after the initial discovery in 1954. Geologists of Mount Isa Mines Ltd. based their early airborne scintillometer surveys on the assumption that uranium deposits occurred in certain horizons of the Eastern Creek Volcanics as a result of deposition during sedimentation. Subsequently a large number of deposits were found in the Eastern Creek Volcanics but it is considered that this has not substantiated the concept of syngenetic deposition. The uranium has been found in a variety of arenaceous and calcareous sediments and also in altered basalts. The iron oxide minerals which are commonly associated with uranium mineralization have been shown to be introduced gangue minerals in the small number of ores examined. The complexity of faulting makes it almost impossible to correlate sedimentary beds from one deposit to another except over short distances, and no reliable marker beds are available. In most deposits well-defined structural controls are evident and these have been described in the previous section. Granites intrude the Eastern Creek Volcanics but the deposits in the Paroo Creek–Calton Hills area show no obvious relationships to intrusive igneous activity and individual deposits are as much as 25 miles away from the nearest outcropping granite. However, the Spear Creek–Mica Creek deposits appear to be genetically related to the Sybella Granite (*see* section on Easter Egg type deposits, page 12).

With regard to the *Mary Kathleen*, Matheson and Searl (1956) state " The mineralization is regarded as epigenetic, the mineralising solutions being a late stage emanation from the granitic magma." The granite referred to occurs some two miles to the east of the deposit and a number of acid dykes radiate from the western margin of the granite. In the same area, and

as far west as the *Mary Kathleen*, garnetization of the Corella Formation is extensive. Several minor occurrences of uranium have been found in areas of garnetization in addition to the *Mary Kathleen*. Thus, the field evidence indicates a close genetic relationship between the eastern granite and the *Mary Kathleen* deposit.

Very little is known about the torbernite-ironstone type of deposit. However, the occurrence of a flourite gangue associated with sulphide mineralization at the *Monakoff* and *Milo* deposits is suggestive of an epigenetic origin and a genetic relation to granitic intrusions even though no granite intrusions crop out near the deposits.

Lawrence *et al.* (1957) considers that the davidite deposits of the Cloncurry–Mount Isa area were deposited syngenetically with the calcareous sediments of the Corella Formation and redeposited in their present form by regional metamorphism. In the deposits examined by Lawrence no direct evidence of an association with igneous activity could be found. The fact that, with few exceptions, the davidite deposits occur in the Corella Formation is suggestive of a depositional relationship. However, taking the davidite-type deposits as a whole, more than half occur in or adjacent to pegmatite and other granitic rocks, and in no case is granite far removed from them. At the *Six Kangaroos* where davidite occurs in a lens of recrystallised calcite it appears that the davidite has been redeposited with the calcite but the original mode of deposition cannot be conclusively determined.

The strathigraphic distribution and the importance of lithological control of uranium mineralization give some grounds for a syngenetic theory of origin. However when the geology of the deposits is considered in detail it is found that this theory is difficult to support. This is in agreement with the conclusion reached by Carter (1955). There is fairly strong evidence for an epigenetic origin and a relationship to granitic intrusion in the case of the Mary Kathleen and Davidite Type deposits. For the other groups of deposits there is meagre evidence which is suggestive of a similar origin. The probable supergene, epigenetic origin of the deposits in the Westmoreland Conglomerate has been referred to in the previous section on controls in ore localization.

DEVELOPMENT AND RESERVES

In 1954 five hundred and ninety-one uranium leases were taken up totalling 17,670 acres and distributed over an area of approximately 10,000 square miles. Information is given on 180 leases or localities which contain radioactive anomalies known or assumed to be due to the presence of uranium. Of these, 128 have been confirmed as uranium occurrences by the analysis of samples. Many leases were taken up to cover the possible extension in depth or along the strike of known uranium deposits. On many others the radioactivity is so restricted in extent or so weak in intensity that the leases would merit no further attention even if the economics of uranium mining changed radically in favour of the producer. Most of the leases taken up in 1954 have since been forfeited and in some cases the original lease areas have been taken up later under different names.

Table 2 gives information on 73 leases on which surface or sub-surface exploration has been carried out in addition to radiometric mapping. Of these, the exploration on 43 leases consisted only of costeaning to remove soil cover or to enable sampling to be carried out. Seventeen deposits have been tested by drilling. The total number of diamond drill holes put down to the end of 1958 was 176 with a total footage of 62,382. One hundred and thirteen diamond drill holes with a total footage of over 46,000 have been put down at the *Mary Kathleen* so that the amount of drilling elsewhere has not been very great. Further exploratory drilling is being carried out on the *Counter*, *Skal* and *Mary Kathleen* deposits. Eleven deposits have been tested by shaft-sinking, driving and crosscutting. Most of the workings are to a depth of less than 50 feet and the deepest shaft has been sunk on the *Helafells* to a depth of 240 feet. Of the prospects tested, only the *Mary Kathleen* has so far proved to be of major economic importance. Two other deposits, the *Counter* and *Skal*, have good prospects of development on a smaller scale than the *Mary Kathleen*. In addition, there are 14 deposits which may contribute small quantities of ore if a buying point is established on the field.

Metallurgical tests have been carried out on ores from the *Mary Kathleen*, *Counter*, and *Skal*. A satisfactory acid leach process has been applied to the *Mary Kathleen* ore and an 86 per cent. recovery is being obtained. The *Counter* ore constitutes a difficult metallurgical problem but an economic process of treatment may be possible using an alkali leach under pressure. The *Skal* ore is amenable to a hot acid leach after the removal of the calcite from the ore.

For the purposes of discussion of the exploration, development and future prospects, the uranium are here divided into several geographical groups.

1. Calton Hills

The largest known deposits in this group are the *Surprise* which has 180 tons per vertical foot with a grade of 0·13 per cent. U_3O_8 and the *Barrier* with 190 tons per vertical foot of 0·10 per cent U_3O_8. The highest grade ore occurs in a small ore-shoot on the *Duke* lease which has 30 tons per vertical foot with a probable grade of the order of 0·30 per cent. U_3O_8. In few of the deposits does the grade greatly exceed 0·10 per cent. U_3O_8. Practically nothing is known of the nature of the deposits at depth. No diamond drilling has been carried out and the only shaft sinking has been at the *Duke* and *Batman* leases to a maximum depth of 17 feet. The deposits range from 50 to 80 miles by road from Mount Isa and the distance to *Mary Kathleen* would exceed 90 miles. It may be possible to develop small, higher grade ore-shoots such as the one on the *Duke* lease but the prospects are not particularly good.

The Calton Hills area has been fairly well prospected by both airborne scintillometer surveys and ground parties although some localities are difficult of access and may not have been fully tested. Further exploration of such deposits as the *Elaine Mary* and the *Duke* is warranted.

Outcrop of the " Pile " one of the earliest uranium deposits to be discovered in North-Western Queensland.

2. Paroo Creek

Deposits on the *Skal* lease were investigated by Mount Isa Mines Ltd. because there seemed some prospects that the deposits would be large enough to warrant the erection of a treatment plant. In addition, other deposits within a few miles of the *Skal* such as the *Hopeful* and *Pile* were expected to be able to contribute substantial additional tonnages of ore. The deposits are rather conveniently situated in regard to access. Mount Isa is 25 miles distant by road, including 19 miles via the bitumen-surfaced Barkly Highway.

The surface grade of the two ore-shoots on the *Skal* was found to be only 0·05 per cent. U_3O_8 but the grade indicated by the 100 feet drill intersections is 0·16 per cent. U_3O_8. Ore reserves are of the order of 300,000 tons. The best section of the *Pile* deposit has 500 tons per vertical foot of 0·07 per cent. U_3O_8 and the best section of the *Hopeful* has 170 tons per vertical foot of 0·06 per cent. U_3O_8. Thus with the exception of the *Skal*, the average grade of the Paroo Creek deposits is less than 0·10 per cent. U_3O_8. It may be possible to selectively mine the higher grade sections of such deposits as the *Skal* and small isolated deposits such as those at *Mount Spring No.* 2.

Being convenient of access, the area came under careful scrutiny during the prospecting boom of 1954, and it is unlikely that outcropping deposits of any significant size have been overlooked.

3. Spear Creek

All the deposits of this group are small and usually consist of elongate ore-shoots of erratic width. They are all situated within 10 miles of Mount Isa. The *Flat Tyre* and *Mother's Day No.* 3 have been partly explored by shaft-sinking, driving and crosscutting and the *Midnight–Easter Egg* has been diamond drilled. Preliminary work on ore from the *Flat Tyre* indicates that it would be amenable to an acid leach process of extraction after very fine grinding.

The largest deposits of the group are the *Mighty Glare* which has 130 tons per vertical foot of 0·08 per cent. U_3O_8, and the *Perseverance* which has 65 tons per vertical foot of 0·22 per cent. U_3O_8. Usually the deposits have less than 50 tons per vertical foot and the grade is commonly within the 0·10 per cent. to 0·20 per cent. U_3O_8 range. It is possible that deposits such as those on the *Perseverance*, *Flat Tyre*, *Easter Egg–Midnight*, *Nevercantell*, *Folderol No.* 2, and 3, and *Eldorado No.* 1 leases may be economically developed by small scale, selective mining. The area has been subjected to thorough prospecting.

4. Gorge Creek

Of the deposits in this group, the *Counter* is by far the largest and is the only deposit to be systematically tested by diamond drilling. The deposits are readily accessible, being 5 to 20 miles by road from Mount Isa

and from 35 to 50 miles from Mary Kathleen. The *Counter* has 650 tons of ore per vertical foot of 0·19 per cent. U_3O_8 at the surface and diamond drilling has indicated that the mineralization persists strongly to a depth over 800 feet. Other known deposits in the Gorge Creek area are usually irregular, small and lenticular and have a grade of less than 0·19 per cent. U_3O_8. The more promising deposits are the *Geiger* (65 tons per vertical foot of 0·13 per cent. U_3O_8), the *Depression* (30 tons per vertical foot of 0·37 per cent. U_3O_8) and the *Gorge* (15 tons per vertical foot of 0·21 per cent. U_3O_8). The further exploration of known deposits in the Gorge Creek area is considered to be more likely to produce favourable results than the search for new deposits. A diamond drilling programme on the *Counter* deposit is in progress to prove the deposit to a depth of 1,000 feet.

5. Mary Kathleen

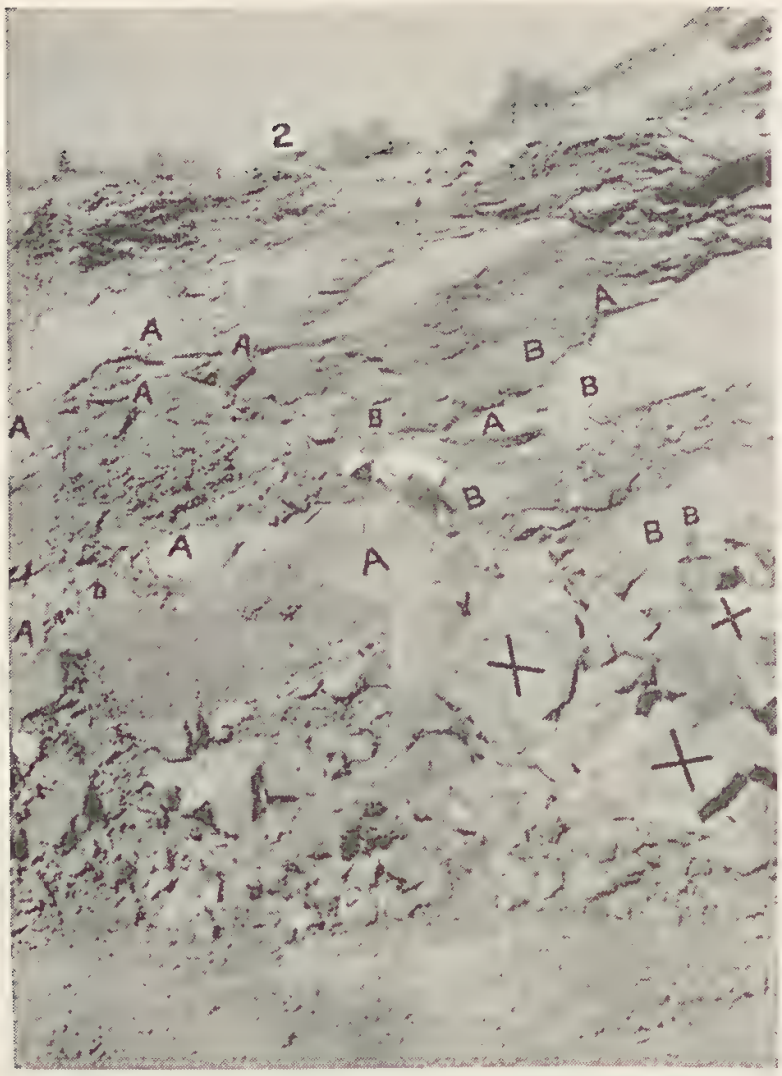
The *Mary Kathleen* is the only operating uranium mine in the region. In 1958 it was estimated by the operating Company to contain nearly 6 million tons of ore with an average grade of 0·143 per cent. U_3O_8, and diamond drilling has since shown extensions of ore values at depth. Intensive prospecting of the Mary Kathleen area for similar deposits has not met with success outside the *Mary Kathleen* leases. On the *Elaine Dorothy* leases, the best deposit is estimated to contain only 5,000 tons of 0·28 per cent. U_3O_8. Other prospects have been test-drilled but only very low grade mineralization has been found. The Corella Formation in which the *Mary Kathleen* occurs has been subjected to a considerable amount of airborne and ground prospecting but no significant deposits of the *Mary Kathleen* type have been found. In spite of the amount of exploratory work which has already been carried out the best prospect for the discovery of new deposits still appears to be the area of garnetized Corella metasediments between the granites to the east and west of the *Mary Kathleen*.

6. Cameron River–Corella River

The davidite-type deposits of this group aroused the interest of private prospectors because of the very high radio-activity exhibited by specimens of davidite which commonly occurred in considerable abundance in the soil around the outcrop of the deposits. The amount of material in situ was usually found to be quite small and was commonly scattered through the host rock in a sporadic fashion. The largest of the deposits is the *Three Brunettes* which has 400 tons per vertical foot of 0·013 per cent. U_3O_8. Thus the davidite is too sparsely distributed to constitute a mineable deposit.

View of Mary Kathleen treatment plant. Stockpiles of uranium ore on right.

[*Photo by "Courier-Mail".*



Mary Kathleen open-cut bench shows the classification of the rock face into A and B class ore, and waste (indicated by crosses) to enable selective mining.

[Photo by "Courier-Mail".

7. Cloncurry–Mount Cobalt

The four deposits of this group which have been tested by underground exploration (*Monakoff*, *Embla Ridge*, *Helafells*, and *Milo*) have shown that though the deposits may be of considerable size, the grade is usually well below 0·10 per cent. U_3O_8. The *Monakoff* has 350 tons per vertical foot with a grade of less than 0·05 per cent. U_3O_8. There is a small deposit of torbernite ore at the *Milo* but no significant primary uranium mineralization was intersected by diamond drilling.

The Corella Formation, part of the Soldier's Cap Formation and the formations in the Mount Cobalt area have been explored by airborne scintillometer surveys, but the Cloncurry–Mount Cobalt area as a whole has been less throughly tested for uranium than the areas previously described.

8. Westmoreland

The Westmoreland deposits are among the most important to have been located as a result of airborne scintillometer surveys.. The *Redtree* deposits are fairly extensive but the grade is very low (probably less than 0·05 per cent. U_3O_8). Pits to a depth of 11 feet and wagon-drill holes to a depth of 120 feet have been put down but no accurate estimate of ore reserves can be made. The remoteness of the area and lack of communications would create formidable obstacles to the development of deposits in this area.

TABLE 2.—EXPLORATION AND MINING DATA (Up to 31/12/1958)

Company or Lessee	Lease	Locality	Trenching and Costeaning	Diamond Drilling		Shaft Sinking	Driving	Cross-cutting	Ore Raised	Remarks
				No. of Holes	Footage					
			Feet			Feet	Feet	Feet	Tons	
Australasian Oil Exploration Ltd.	Queen's Gift No. 2	Calton Hills	72	..	..	..	..	..	..	Shallow sampling costeans
	Thanksgiving	Spear Creek	?	..	..	..	..	..	..	One costean
	Easter Egg		75	..	..	..	..	..	..	
	Eldorado No. 1		139	..	..	..	..	..	..	
	Eldorado No. 2		110	..	..	..	..	..	..	
	Eldorado No. 3		?	..	..	..	..	..	..	One costean
	Mighty		46	..	..	..	..	..	..	
	Counter		500	8	2,483	..	..	..	..	Also 20 pits. Length 155′ Depth 105′
	Geiger	Gorge Creek	59	..	..	..	..	..	..	
	Battery		50	..	..	..	..	..	..	
	New Ring		217	..	..	..	..	..	..	
	Mary Kathleen		2,500	5	2,702	..	..	..	..	See also Mary Kathleen Uranium Ltd.
Brown, R. G. and party	The Springs	Ballara	44	..	..	..	..	..	..	
Gold Mines of Australia Ltd.	Monakoff and Tinboll No. 1–5	Cloncurry	..	3	1,225	93	..	46	..	3 small opencuts worked for copper in early days
	Tinboll No. 6		..	1	248	..	..	..	..	
	Janet Maude	Cameron River	?	..	..	..	..	..	..	4 costeans
	Mount Harold		?	..	..	..	..	..	..	1 costean
Isa Uranium Syndicate	Devils Marbles	Calton Hills	?	..	..	..	..	..	..	3 costeans
MacLeod and party	Amy and Diane	Cameron River	10	..	..	..	..	..	..	
Mary Kathleen Uranium Ltd.	Mary Kathleen		..	113	43,663	..	136	250	384,173	Open-cut mining commenced in 1956
Merridale Minerals Pty. Ltd.	Utah	Mount Cobalt	48							Also small open-cut 10 feet deep
	Mariposa		32							
Mineral Ventures N.L.	Elaine Dorothy	Mary Kathleen	?	11	2,323	..	..	..	..	22 short costeans
	Armstrong North		..	2	679	..	..	..	..	
	Millicent Martha	Gorge Creek	?	1	256					1 costean
	Yvonne Theresa		?	1	341					6 shallow costeans
	Broken Horseshoe		?							Some costeaning
	Janelle	Spear Creek	?							Some costeaning
	Pamela		?							Some costeaning
Mining Corporation N.L.	Helafells	Cloncurry	10	..	...	240	..	101	..	23 wagon drill holes footage 1,736
	Sierra Rada		22							
Mount Isa Mines Ltd.	Barrier	Calton Hills	75	..	..	..	..	..	..	
	Impassable		315	..	..	..	..	..	..	
	Bikini		15	..	..	..	..	..	..	
	Hopeful	Paroo Creek	60	..	..	..	..	..	..	
	Isotope		55	..	..	..	..	..	..	
	Pile		390	4	1,280	..	..	..	..	
	Skal		1,211	9	2,964	..	..	..	..	
	Skal Again		1,220	..	..	..	..	..	..	
	Mighty Glare	Spear Creek	161	..	..	..	..	..	..	
	Folderol		30	..	..	..	..	..	..	
	Nevercantell		50	..	..	..	..	..	..	

TABLE 2.—EXPLORATION AND MINING DATA (Up to 31/12/1958)—*continued*

Company or Lessee	Lease	Locality	Trenching and Costeaning	Diamond Drilling		Shaft Sinking	Driving	Cross-cutting	Ore Raised	Remarks
				No. of Holes	Footage					
			Feet			Feet	Feet	Feet	Tons	
Mount Isa Mines Ltd.—*continued*										
	Perseverance ..	Spear Creek ..	26	..	..	..	..	..	..	
	Bambino		20	..	..	..	..	..	..	
	Bitmore		15	..	..	..	..	..	..	
	Hobby No. 2 ..	Cameron–Corella River	172	..	..	..	..	..	..	
	Leydin's Ridge ..		15	..	..	..	..	..	..	
	Three Brunettes ..		1,055	..	..	..	..	..	..	
	Verpat No. 1 ..		110	..	..	..	..	..	..	
	Milo	Cloncurry ..	170	..	..	30	..	20	..	See also Paringa Wheal Fortune Pty. Ltd.
	Mount Cobalt ..		..	1	310	..	..	..	..	
	Redtree	Westmoreland	..	..	..	69	..	..	..	900′ of wagon-drilling
Paringa Wheal Fortune Pty. Ltd.	Milo	Cloncurry ..		4	1,366	120	..	..	..	See also Shiel and party
Queensland Mines Ltd.	Counter	Gorge Creek ..	..	See "Remarks" ditto		..	..	..	..	Diamond drilling in progress (1959)
	Skal	Paroo Creek ..	..			..	..	..	..	
Rio Tinto Australian Exploration Pty. Ltd.	Rita	Mary Kathleen	..	4	469	..	..	..	..	
	Rary		..	1	147	..	..	..	..	
Shiel and party	Milo	Cloncurry ..	?	..	..	..	25	..	10	Also several shallow pits and trenches
United Uranium N.L.	Flat Tyre	Spear Creek ..	1,100	..	..	54	..	78	100	Also 8 feet of rising
	Lucky Boy		?							Soil cover bulldozed off
	Lucky Break ..		900							
	Midnight		..	5	1,091	..	..	..	..	
	Mother's Day No. 1		?	..	..	..	..	..	..	Soil cover bulldozed off
	Mother's Day No. 3		50	..	..	50	79	17	250	
	Jeanie		2,000	..	..	..	..	..	..	
	Patch									
	Repair									
	Riddle									
	Sleeve									
	Rewa		500	..	..	..	..	..	..	
	Valhalla	Paroo Creek ..	1,200	1	395	54	..	51	..	Also 13 feet shaft by lessees
	Pelican	Ballara ..	660	..	..	12	..	..	..	
	Ballara No. 1, 2 ..		?	..	..	..	..	..	..	A few shallow pits
	Embla Ridge ..	Cloncurry ..	..	2	440	..	..	..	..	
Uranium Search Pty. Ltd. ..	Six Kangaroos ..	Cameron River	90	..	..	..	..	..	..	
	Comfort		?							4 short costeans
Walton Syndicate	Batman	Calton Hills ..	54	..	..	21	..	6	..	
	Duke		50	..	..	18	..	..	..	

PART II–INDIVIDUAL URANIUM DEPOSITS

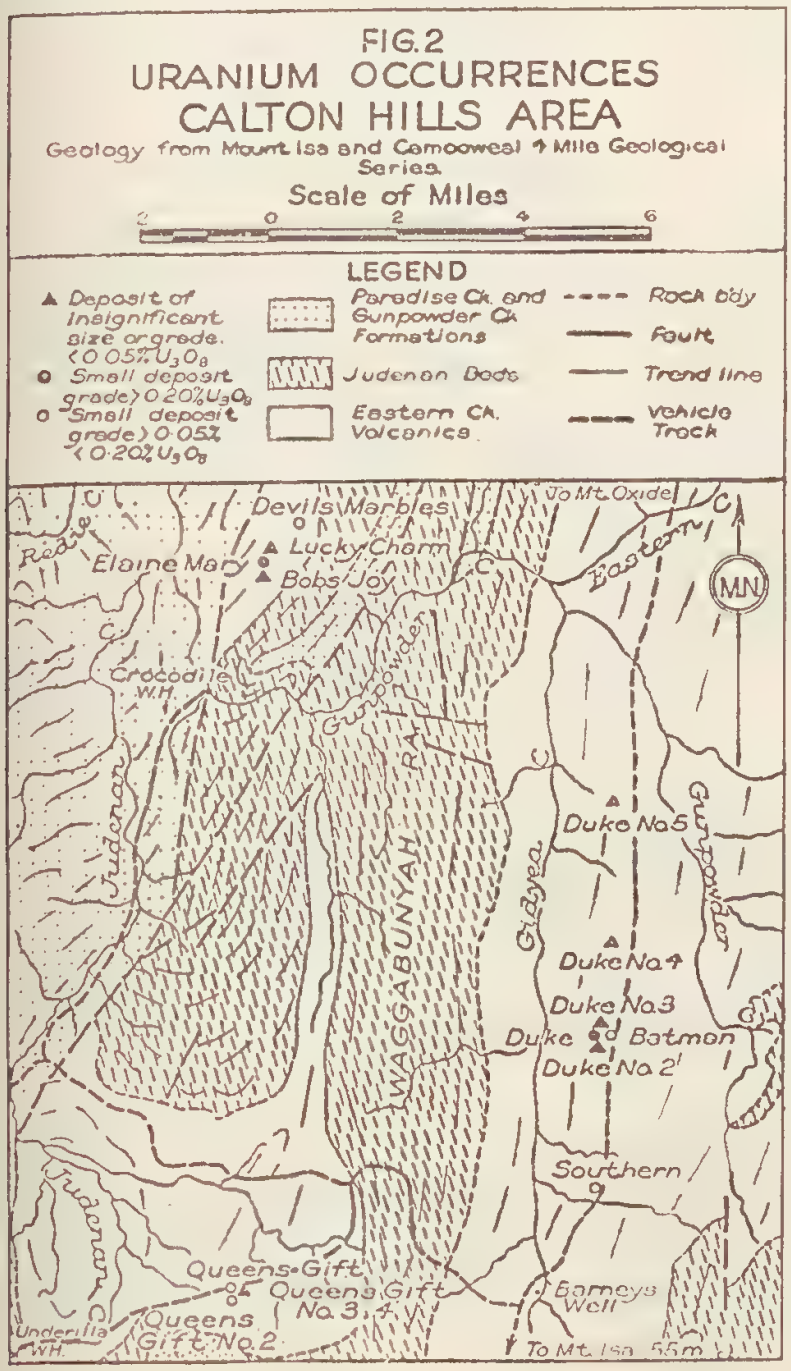
CALTON HILLS GROUP (see Fig. 2)

In this Group the *Barrier*, *Elaine Mary*, *Surprise Mount Rover*, and deposits on adjacent leases are of the Surprise sub-type but the remainder are of the Skal sub-type. All the deposits are in the Eastern Creek Volcanics. The primary uranium mineral has not been positively identified but Dallwitz and Roberts (1955 unpub.) attribute the radioactivity in ore from the *Impassable* and *Elaine Mary* leases to uraniferous magnetite.

Barrier

Location : 13 miles north-east of Calton Hills homestead and 46 miles north of Mount Isa. The *Impassable* and *Conquest* are adjacent leases to the south and north respectively.

The regional strike is N. 20 deg. W. and the dip is to the east. Carbonated, chloritized and albitized basalt is the host rock and quartzite, epidote quartzite, argillaceous sandstone, and slate occur interbedded with the altered volcanics. Fracture cleavage is not strongly developed.



At the surface the deposit is 190 feet long by 30 feet wide and the average grade is 0·10 per cent. U_3O_8. Mount Isa Mines Ltd. took up the lease and carried out 75 feet of costeaning.

Batman

Location : 11 miles north-north-west of Calton Hills homestead and 52 miles north of Mount Isa. It is adjacent to the *Duke* lease on the east.

The host rock is a fractured siltstone which contains a considerable amount of introduced calcite and quartz. The siltstone strikes approximately east-west and dips steeply to the south. It is interbedded with chloritized, schistose basalt and calcareous quartzite. Exposures in the prospecting shaft indicate that the uraniferous siltstone has been disturbed by strike faulting and this is expected to create difficulties if the development of the deposit is attempted. Assuming the lode is continuous between outcrops and exposures in costeans and the shaft, it would have a total length of 160 feet and a width of 5 feet. Assays of representative samples have ranged from 0·09 per cent to 0·33 per cent. U_3O_8 and have averaged 0·18 per cent. U_3O_8. However, the number of samples is insufficient for this to be taken as the grade of the deposit. The lessees, Walton and party, have sunk a shaft to a depth of 17 feet and excavated three costeans.

Conquest

The deposit on this lease which is situated adjacent to the *Barrier* lease on the north was mapped and sampled by Mount Isa Mines Ltd. It is 120 feet long and 20 feet wide and has a grade of 0·013 per cent. eU_3O_8.

Devil's Marbles

Location : 3 miles north of Crocodile waterhole on Gunpowder Creek and 60 miles north-north-west of Mount Isa.

The uranium mineralization occurs in hematitic quartzite interbedded with chloritized basalt of the Eastern Creek Volcanics. Costeans at 110 feet, 155 feet, and 215 feet north of the lode datum showed a narrow width of highly radioactive lode with an envelope exhibiting less intense radioactivity. A sample taken by Isa Uranium Syndicate N.L. assayed 0·64 per cent. U_3O_8. The average grade is not known.

Duke

Location : 52 miles north of Mount Isa and on the eastern side of Top Gidyea Creek 6 miles north of Barney's Well. The track to the *Mount Oxide* copper mine passes a short distance east of the deposit. The *Batman* lease is adjacent on the east and the *Duke No.* 2 lease is adjacent to the south.

Uranium mineralization occurred where faulting shattered the metabasalts against the more competent lenticular beds of quartzite. Considerable amounts of quartz, hematite, and calcite have been introduced.

Radioactivity is almost confined to the quartzitic beds. The highest grade ore occurs in a dense, hematitic, jasperoid quartzite. Samples of the material have assayed as high as 1·11 per cent. U_3O_8 (chem.).

Four separate areas of radioactivity occur on the lease. Two exhibit only weak, sporadic radioactivity and appear to be of no commercial significance. The most important deposit strikes N. 54 deg. E., and has a length of 40 feet and an average width of 9 feet. The lessees, Walton and party, have explored the deposit by three costeans and two pits to a depth of 10 feet and 8 feet. Only two representative samples have been taken and these averaged 0·30 per cent U_3O_8. The other deposit strikes N. 68 deg. W., and has a length of 82 feet and a width of 5 feet to 6 feet. One representative sample assayed 0·18 per cent. eU_3O_8. A yellow secondary uranium mineral coats the joint planes in the high grade ore but the primary uranium mineral is evidently finely disseminated and it has not been determined.

Duke No. 2

The lease is adjacent to the *Duke* on the south. One radiometric anomaly occurs on this lease over a length of 30 feet. Samples taken by the lessees assayed 0·16 per cent. eU_3O_8 and 0·35 per cent. U_3O_8 (chemical) but it is considered that the average grade is probably lower than either of these assays indicate.

Duke No. 3

This lease is a short distance north of the *Batman* and *Duke* leases. Only one small area of weak radioactivity occurs on it and this is not considered to be of any economic significance.

Duke No. 4

Location : 2 miles north of the *Duke* and *Batman* leases.

Radioactivity occurs in two parallel lodes 100 feet apart. The lodes strike N. 5 deg. E. The larger exhibits intermittent radioactivity over a length of 120 feet and an average width of 5 feet. The other is 36 feet long and has a maximum width of 7 feet. No assay data are available, but the intensity of radioactivity is much lower than in the main deposits on the *Duke* and *Batman* leases.

Duke No. 5

Location : 4 miles north of the *Duke* and *Batman* leases.

There are three parallel, *en echelon*, radiometric anomalies with a strike of N. 5 deg. E—approximately the regional strike of the Eastern Creek Volcanics in this area. The dimensions of the three anomalies are 100 feet by 4 feet, 45 feet by 3 feet and 72 feet by 3 feet. The intensity of radioactivity is weak in comparison with the main deposits in the *Duke* and *Batman* leases.

Elaine Mary

Location: 2½ miles north-north-east of Crocodile water-hole on Gunpowder Creek and 60 miles north-north-west of Mount Isa. The track to Crocodile waterhole leaves the *Mount Oxide* copper mine track a few miles south of Barney's Well.

The regional strike is north-north-east and the dip is steeply east to vertical. Arenaceous sediments are dominant in the area but the uranium occurs in strongly fracture-cleaved and altered vesicular basalt which is interbedded with quartzite. The interbedded, metamorphosed volcanics and sediments form part of the Eastern Creek Volcanics. The lode strikes N. 35 deg. E. and is parallel to the strike of the bedding. Radioactivity occurs in five areas over a length of 225 feet. Extensive faulting has affected the area and the lode has been displaced by cross-faulting at two places. Small quartz-tourmaline veins occur at these places. The altered basalt host rock has a distinct reddish coloration due to finely-divided hematite in calcite. These gangue minerals were introduced during the process of uranium mineralization. The primary uranium mineral has not been positively identified but may be uraniferous magnetite (Dallwitz and Roberts, 1955).

The five radioactive anomalies have areas of 100 square feet, 240 square feet, 2,500 square feet, 324 square feet and 176 square feet. Samples taken by Isa Uranium Syndicate N.L. at intervals over a length of 290 feet assayed 0·16 per cent., 0·48 per cent., 0·15 per cent. and 0·14 per cent. U_3O_8 (chemical). This deposit is remote and virtually unexplored but it is one of the more promising of this type.

The *Lucky Charm* and *Bob's Joy* leases adjoin the *Elaine Mary* on the north and south respectively. The small radioactive anomalies on the leases are on the same line of strike as those on the *Elaine Mary*. The *Teddies' Gift* lease adjoins the *Elaine Mary* lease on the east.

Impassable

This lease is adjacent to the *Barrier* on the south. Two main radioactive anomalies occur on a north-north-westerly line of strike. The southern anomaly is 110 feet long by 40 feet wide and has a surface grade of 0·01 per cent. eU_3O_8. The northern anomaly which consists of eastern and western sections, is 200 feet long by 25 feet wide and has a surface grade of 0·035 per cent. eU_3O_8. Radiometric mapping and sampling was carried out by Mount Isa Mines Ltd.

Mount Surprise

Location : 53 miles north of Mount Isa, 14 miles north-east of Calton Hills homestead and south of the *Surprise* lease.

The Eastern Creek succession strikes north-south and dips west. It consists of meta-basalt with interbedded quartzite and slate. The host rock is a hematite-stained, quartz siltstone. Radioactivity can be traced over a distance of 600 feet but no deposits of significance have been found. The *Pickwick* and *Shiny's Luck* are 4 miles north-east of *Mount Surprise*. The geology and uranium mineralization is similar to that on the *Mount Surprise* lease.

Queen's Gift

Location : 5 miles west-south-west of Barney's Well and 50 miles north-north-west of Mount Isa. The track to the lease leaves the Crocodile water-hole track on the western side of the Waggabunyah Range.

The principal rock types in the area are chloritized basalt, and quartzose and calcareous sandstone. The uranium mineralization occurs within a zone of strike faulting which is marked by a prominent outcrop of quartz at the southern end of the lease and an outcrop of limonitic quartz lode material at the northern extremity of the lease. The fault, which parallels the fracture cleavage, strikes N.15 deg. E. and dips vertically. Uranium mineralization is confined to a fine-grained, hematite and calcite-bearing, quartzose sandstone. The hematite and calcite appear to have been introduced with the uranium. No primary uranium mineral has been determined.

Four small radioactive anomalies occur over a strike length of 1,000 feet. The dimensions of the anomalies are 23 feet by 8 feet, 58 feet by 4 feet, 28 feet by 11 feet and 45 feet by 12 feet. The average surface grade is 0·08 per cent. U_3O_8. The *Queen's Gift* leases were mapped and sampled by Australasian Oil Exploration Ltd. (see Fig. 3).

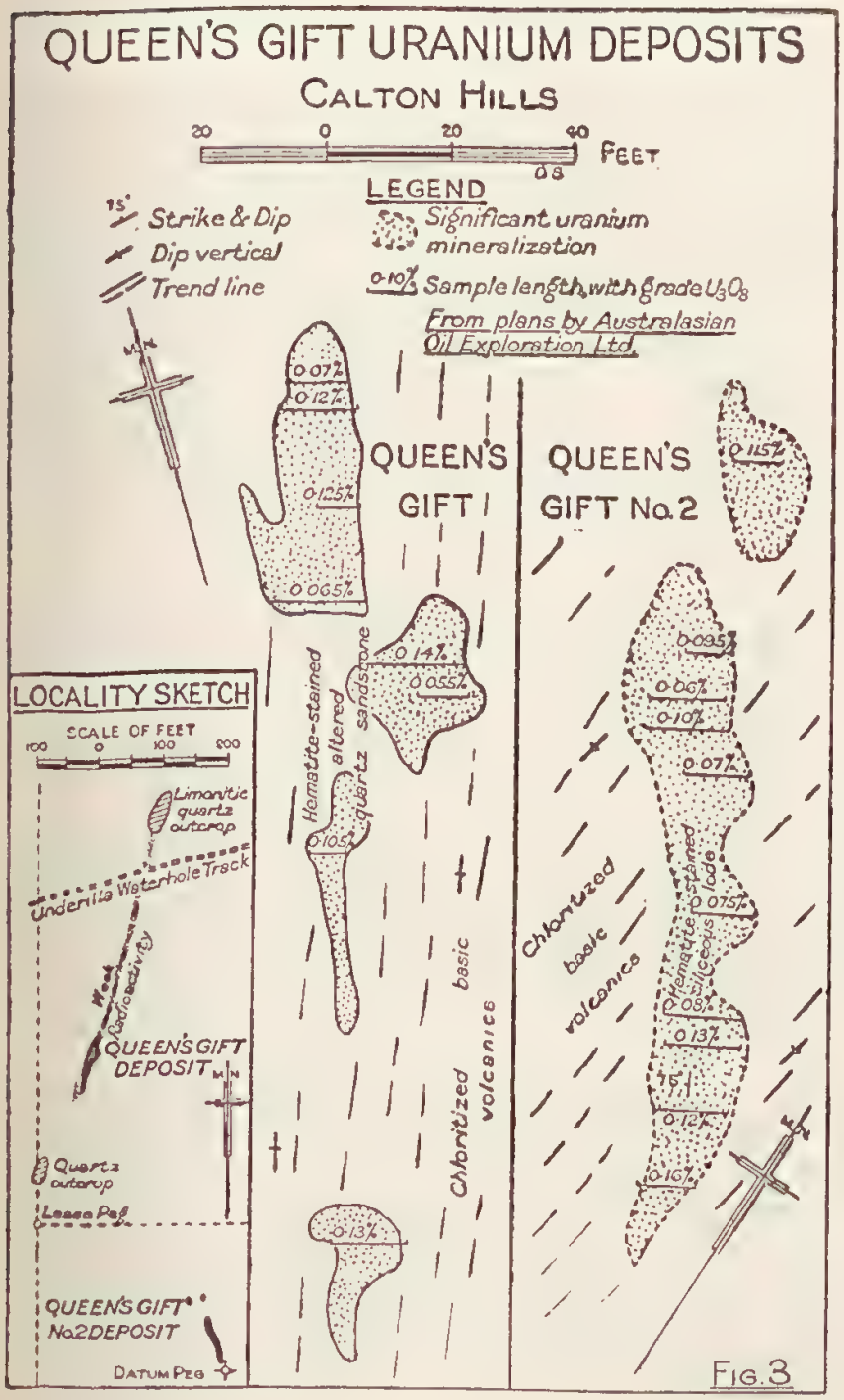


FIG. 3

Queen's Gift No. 2

This lease is adjacent to the *Queen's Gift* on the south. Three areas of radioactivity occur on this lease but only one of these is of possible economic significance. The main occurrence is in a quartz lode carrying some hematite. The strike of the lode is N. 25 deg. W. so that it transgresses the strike of the chloritized basalt country rocks which strike N. 15 deg. E. The dip of the lode appears to be 75 deg. west. It is 110 feet long and 9 feet wide and has an average surface grade of 0·09 per cent. U_3O_8. Coatings of a yellow secondary uranium mineral are visible on some joint planes but no attempt has been made to determine the primary uranium mineral.

There are other radioactive anomalies of weaker intensity on the adjacent *Queen's Gift No.* 3 and 4 leases.

Slance

This lease is in the Surprise group, 20 miles north-east of Calton Hills homestead. The radioactive anomaly is 210 feet long and 20 feet wide and has a grade of 0·02 per cent. eU_3O_8. It was mapped and sampled by Mount Isa Mines Ltd.

Southern

This is the southernmost of the Duke sub-group of leases and is 2 miles north of Barney's well. Radioactivity occurs in beds of calcareous and hematitic quartzite over a length of 155 feet and an average width of 3 feet. The principal anomaly is 65 feet long and 4 feet wide. A representative sample assayed 0·12 per cent. U_3O_8.

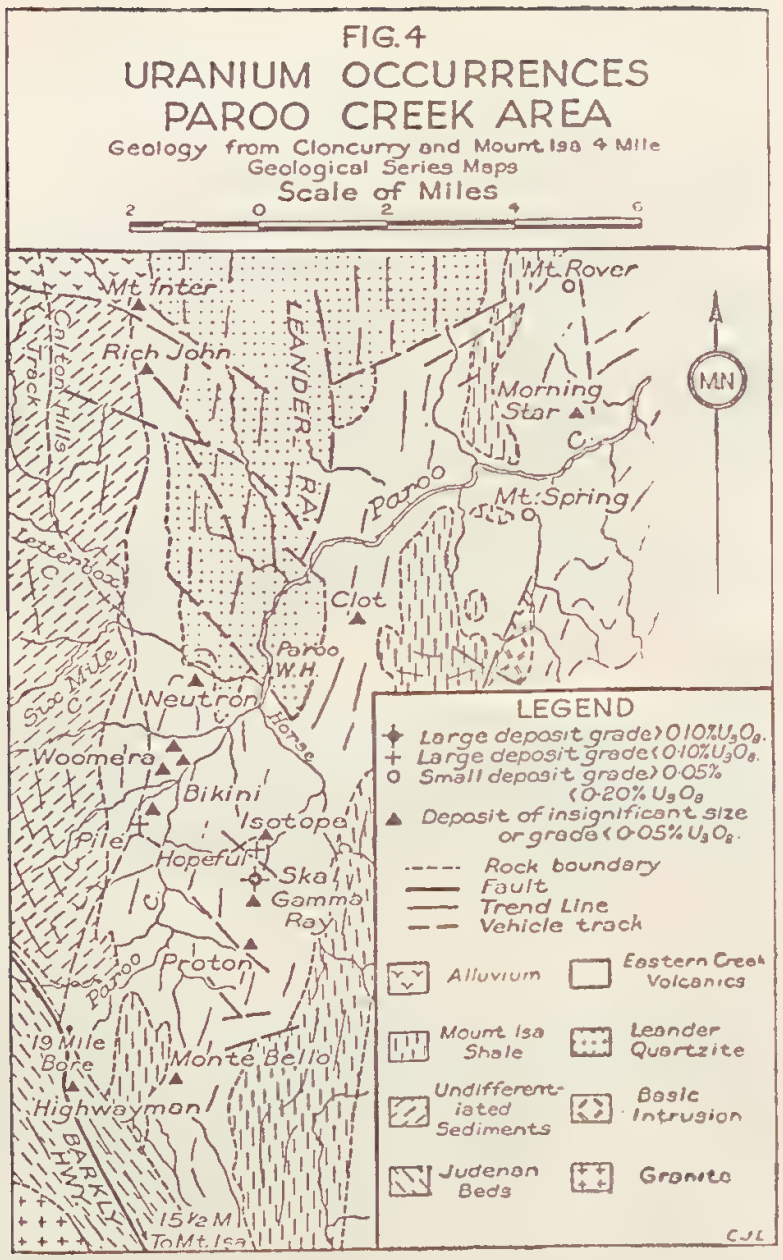
Surprise

Location : 21 miles north-east of Calton Hills homestead and 57 miles north-north-east of Mount Isa.

The *Surprise* is typical of a sub-group within the Eastern Creek type of deposit. The host rock is a chloritized and carbonated basalt. The uranium mineralization is conformable with the N. 20 deg. W. strike of the country rocks. The dip is 30 deg. to 60 deg. E. Fracturing is more pronounced within the area occupied by the radioactive anomalies. No uranium minerals have been identified. The main deposit is 150 feet long by 18 feet wide and has a surface grade of 0·13 per cent. eU_3O_8. A second deposit is 180 feet long by 2 feet wide and has a grade of 0·054 per cent. eU_3O_8. There is a third group of radioactive anomalies but these are of little significance. The lease was mapped and sampled by Mount Isa Mines Ltd.

PAROO CREEK GROUP (see Fig. 4)

All the deposits in this group with the exception of the *Valhalla* and *Mount Rover* are in the *Skal* sub-type of the Eastern Creek deposits. The only determinations of primary uranium minerals have been made in ores from the *Skal* (brannerite) and the *Pile* (brannerite and uraniferous magnetite).



Betatron

The *Betatron* is adjacent to the *Womera* lease on the south-western side. A small deposit* on the lease has a grade of 0·013 per cent. eU_3O_8. It was sampled by Mount Isa Mines Ltd.

Bikini

This lease is adjacent to the *Pile* on the north-east. The uranium deposits are on the same line of strike as those on the *Pile*. There are six main radioactive anomalies with dimensions of 200 feet by 10 feet, 20 feet by 12 feet, 90 feet by 20 feet, 70 feet by 30 feet, 20 feet by 10 feet and 60 feet by 10 feet. The average grade is 0·027 per cent. eU_3O_8. The lease was sampled by Mount Isa Mines Ltd.

Clot

This lease is 23 miles north of Mount Isa and 4 miles north-east of the *Skal*. Uranium mineralization occurs in two lenses of chloritic and calcareous siltstone which are quartz-veined and impregnated by magnetite and hematite. Strike shearing has taken place in the meta-sediments which strike north to N. 18 deg. E. and dip vertically. The eastern lens is 120 feet long and 1 to 3 feet wide. The western lens which is 75 feet from the eastern lens, is 50 feet long and 1 to 2 feet wide. Some highly radioactive floaters were found on the lease but the outcrop material was considered too low grade to warrant sampling. A selected sample submitted by the lessees assayed 0·10 per cent. eU_3O_8.

Gamma Ray

This lease is adjacent to the *Skal* on the south and the radioactivity on the two leases is on roughly the same line of strike. The radioactive anomaly is small* and the grade is 0·022 per cent. eU_3O_8. It was sampled by Mount Isa Mines Ltd. The *Proton* lease is situated to the south of the *Gamma Ray*. A radioactive anomaly on the lease was considered too small to warrant sampling. The original *Gamma Ray* and *Proton* leases lapsed and the area has recently been taken up as the *Muster No.* 3 lease.

Highwayman

The *Highwayman* lease is situated near the Barkly Highway 18 miles north-north-west of Mount Isa. The radioactivity is of weak intensity and the only significant feature about the occurrences is that it is one of the few to be located in the Judenan Beds.

Hopeful

Location : Half-a-mile north of the *Skal* and 21 miles north of Mount Isa.

Radioactivity occurs in a hematite-stained, massive, calcareous meta-sediment. The fracture cleavage strikes N. 10 deg. W. A small quantity of a yellow secondary uranium mineral is visible in the outcrop but the primary uranium mineral is not known. The radioactive anomaly has overall dimensions of 400 feet by 55 feet. Within this there are two parallel ore-shoots one of which contains 850 tons per vertical foot with a surface grade of 0·031 per cent. eU_3O_8, and the other contains 170 tons per vertical foot with a surface grade of 0·058 per cent. eU_3O_8. The deposit was mapped and sampled by Mount Isa Mines Ltd. Two costeans are the only exploratory workings on the deposit.

Isotope

This lease is to the north-east of the *Hopeful*. It contains a small* uranium deposit with a grade of 0·10 per cent. eU_3O_8. It was sampled by Mount Isa Mines Ltd.

Monte Bello

The *Monte Bello* is situated 18 miles north of Mount Isa and 2 miles east-south-east of the 19 mile bore on the Barkly Highway. It contains a small deposit with a grade of 0·036 per cent. eU_3O_8. The sampling was carried out by Mount Isa Mines Ltd.

Morning Star

Location : 27 miles north of Mount Isa and 9 miles north-north-east of the *Skal*. It is in the Mount Rover sub-group.

The Eastern Creek succession in the area consists of meta-basalt with small lenses of calcareous quartzite. The strike is meridional and the dip is vertical. A micro-gabbro dyke occurs to the east of the deposits and is conformable with the strike of the meta-basalts and the uranium lodes.

* " Small " deposit means less than 40 tons per vertical foot.

Uranium mineralization occurs in two lenses of calcareous quartzite on the same line of strike and separated by 200 feet. The quartzite is impregnated with hematite and magnetite and is cut by numerous intersecting veinlets of quartz. Coatings of a yellow secondary uranium mineral can be seen on some joint faces but no primary uranium mineral is visible.

The southern mineralized lens is 80 feet long and 3 feet wide. The northern lens is 145 feet long and 1½ feet wide. Representative samples indicate that the grade is of the order of 0·04 per cent. U_3O_8.

Mount Inter

Location : 31 miles north of Mount Isa and 4 miles north of the Letterbox Creek crossing on the Calton Hills homestead track.

The regional geology in this locality has not been fully resolved but the mineralization is of the Skal sub-type. The host rock is a dark calcareous quartzite which strikes N. 20 deg. W. to N. 12 deg. W. Crossfaults displace the meta-sediments horizontally up to 20 feet. A yellow secondary uranium mineral is present as coatings on joint and fracture surfaces.

Five lenticular radioactive anomalies occur over a strike length of 19 chains and an average width of 2 feet. The anomaly exhibiting the highest radioactivity is 70 feet long and 6 feet wide. Soil-covered areas separate the radioactive anomalies. No assay data are available but the intensity of radioactivity suggests that the the grade is comparable with other deposits in the Paroo Creek area which have a grade of less than 0·1 per cent. U_3O_8.

Mount Rover Nos. 1–5

Location : 29 miles north of Mount Isa and 11 miles north-east of the *Skal*.

The deposits on the Mount Rover leases are assigned to the Surprise sub-type of the Eastern Creek type. The Eastern Creek Volcanics in the area consist of amygdaloidal meta-basalt with small lenses of fine-grained, calcareous quartzite heavily impregnated with magnetite and hematite. Chlorite is abundant and interlaced quartz veins occur in the uraniferous lodes. Sparsely disseminated crystals of pyrite and chalcopyrite are also present. However, these sulphides are of very widespread occurrence in the Eastern Creek Volcanics and are probably not related to uranium mineralization. The host rock is a chloritised, magnetite-bearing meta-basalt, and uranium deposition appears to have been controlled by fracturing along the strike of the meta-basalt.

On *Mount Rover No.* 1 a radioactive anomaly strikes N. 10 deg. E. and dips steeply to the west. It is 70 feet long and 2 feet wide. A representative sample assayed 0·05 per cent. U_3O_8. Small isolated areas of weak radioactivity occur on *Mount Rover Nos.* 2, 3 and 4. On *Mount Rover No.* 5 the radioactive anomaly strikes N. 5 deg. W. and the dip is vertical. The anomaly is 40 feet long and 1½ feet wide. A representative sample assayed 0·07 per cent. U_3O_8.

Mount Spring Nos. 1 and 2

Location : 25 miles north of Mount Isa and 4 miles from the Mount Rover leases.

The geology is similar to that at the Mount Rover leases but the uranium mineralization occurs in lenses of calcareous quartzite, impregnated with magnetite and hematite.

On the *Mount Spring No.* 1 lease discontinuous lenses occur over a length of 300 feet and a width of 6 inches to 1 foot. The strike is meridional and the dip is vertical. The adjacent meta-basalt shows signs of shearing and small-scale, north-pitching drag folds also occur. A representative sample assayed 0·04 per cent. U_3O_8 (chemical).

On the *Mount Spring No.* 2 lease there are two radioactive anomalies. The southern anomaly is 35 feet long and 1 foot wide ; a representative sample assayed 0·14 per cent. U_3O_8 (chemical). The northern anomaly which is 90 feet to the north-west, is 30 feet long and 1 foot wide ; a representative sample assayed 0·20 per cent. U_3O_8. The grade of the northern anomaly is considerably higher than most of the Paroo Creek deposits but the very small size of the deposit makes it of little economic interest.

Neutron

The *Neutron* is 24 miles north of Mount Isa and 2 miles north-north-east of the *Pile*. A radioactive anomaly on the lease was considered to be too small to warrant sampling.

Pile

Location : 22 miles north of Mount Isa and 2 miles west-north-west of the *Skal*.

The rock succession in the area consists of sheared and chloritized basalts and altered calcareous and arenaceous sediments. Uranium mineralization occurs in a prominently-outcropping siltstone containing introduced quartz, calcite, megnetite, hematite and chlorite. The strike ranges from N. 30 deg. E, to N. 55 deg. E. and the dip is 75 deg.–80 deg. to the south-east. Some coatings of a pale greenish uranium mineral which is believed to be autunite, are visible on joint surfaces. Mineragraphic studies have not led to uniform conclusions on the identity of the primary uranium mineral but it is believed to be finely-disseminated brannerite.

Several radioactive anomalies occur on the lease (see Fig. 6). The largest and highest grade of these is 165 feet long and 40 feet wide. The surface grade is 0·07 per cent. U_3O_8. Mount Isa Mines Ltd. drilled two holes to intersect the lode in the vicinity of 100 feet and a further two holes to intersect the lode in the vicinity of 200 feet. The grade of the 100 feet drill hole intersections was comparable with that at the surface and the 200 feet intersections showed a considerable decrease in grade. Three other smaller radioactive anomalies are on the same line of strike, to the south-west of the main anomaly, but the uranium content decreases in this direction and these anomalies are of no economic significance.

Rich John

This lease is 29 miles north of Mount Isa near the Calton Hills homestead track. It occurs in a lenticular bed of altered sandstone interbedded with meta-basalt Uranium mineralization at the surface is confined to an outcrop 7 feet long and 5 feet wide. A pothole 3 feet deep exposed a patch of highly radioactive material which assayed 0·73 per cent. and 1·20 per cent. eU_3O_8. However, there are no indications of the occurrence of significant amounts of such material.

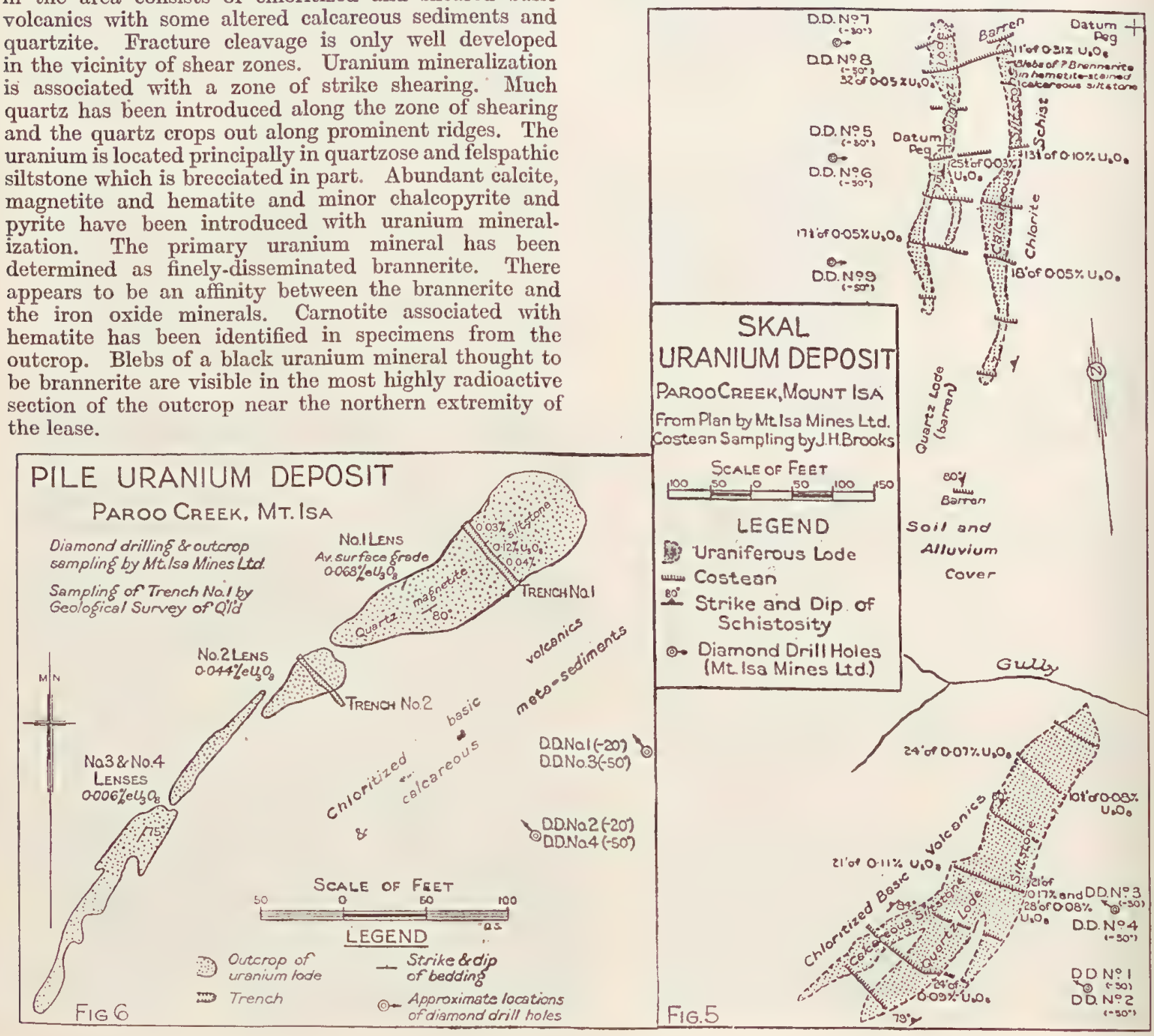
Skal

Location and Access: 21 miles north of Mount Isa. Access is from the Calton Hills homestead track which leaves the Barkly Highway at the 19 mile bore. Distance by vehicle track from the 19-mile turnoff is 6½ miles.

The *Skal* is typical of a rather large group of deposits in the Eastern Creek Volcanics. The rock succession in the area consists of chloritized and sheared basic volcanics with some altered calcareous sediments and quartzite. Fracture cleavage is only well developed in the vicinity of shear zones. Uranium mineralization is associated with a zone of strike shearing. Much quartz has been introduced along the zone of shearing and the quartz crops out along prominent ridges. The uranium is located principally in quartzose and felspathic siltstone which is brecciated in part. Abundant calcite, magnetite and hematite and minor chalcopyrite and pyrite have been introduced with uranium mineralization. The primary uranium mineral has been determined as finely-disseminated brannerite. There appears to be an affinity between the brannerite and the iron oxide minerals. Carnotite associated with hematite has been identified in specimens from the outcrop. Blebs of a black uranium mineral thought to be brannerite are visible in the most highly radioactive section of the outcrop near the northern extremity of the lease.

There are two radioactive anomalies on the lease separated by a distance of 400 feet (see Fig. 5). A faulted relationship probably exists between the radiometric anomalies. The southern anomaly strikes N. 45 deg. E. and the dip is 80 deg. to the north-west. The total length of the uranium lode is 500 feet but the significant section is 370 feet long and 60 feet wide. The surface grade is 0·06 per cent. U_3O_8. Two drill holes intersected the lode at approximately 100 feet and a further two holes intersected it at 200 feet. The grade of the 100 feet intersections was 0·16 per cent. U_3O_8 and the grade of the 200 feet intersections was 0·09 per cent. U_3O_8.

The northern anomaly strikes N. 12 deg. E. and dips steeply to the west. The total length of the anomaly is 400 feet, but the significant section is 300 feet long by 76 feet wide and has a surface grade of 0·04 per cent. U_3O_8. The two 100 feet drill intersections indicated a grade of 0·17 per cent. U_3O_8, and the three 200 feet



intersections indicated a grade of 0·06 per cent. U_3O_8. The northern anomaly contains eastern and western ore-shoots. Of the two, the eastern ore-shoot is of considerably higher grade and the grade decreases from the northern to the southern end of the ore-shoot. If the deposits cannot be developed on a large scale it may be possible to selectively mine the higher grade sections.

In 1954, Mount Isa Mines Ltd. put down 9 diamond drill holes, excavated 19 costeans and carried out systematic surface sampling and mapping. However, the Company did not exercise its option to buy the lease. The lease was purchased by Queensland Mines Ltd. in 1959, and further diamond drilling is being carried out.

Skal Again

This lease (now forfeited) is adjacent to the *Skal* on the east. Fairly extensive costeaning was carried out by Mount Isa Mines Ltd. but no significant extensions to the outcropping radioactive deposit were exposed. A narrow belt of weak radioactivity extends over a length of 900 feet and is roughly parallel to the uranium lodes on the *Skal*. The deposit is now included in the *Muster* lease.

Valhalla

Location : 25 miles north-north-west of Mount Isa and a short distance to the north of the Barkly Highway.

This is an isolated deposit in the Judenan Beds. It cannot be conveniently grouped with any of the major types of deposit. Surface and near-surface radioactivity is due to the presence of disseminated, sporadically-distributed flakes of meta-torbernite. Trenching has exposed an area of weak radioactivity 200 feet by 130 feet in weathered, ferruginous shales. The highest chemical assay from these trenches was 0·06 per cent. U_3O_8. In the prospecting shaft which was sunk to 54 feet the average grade was 0·04 per cent. U_3O_8. A diamond drill hole intersected radioactive material from 333 feet to 357 feet and the section from 341–349 feet assayed 0·10 per cent. U_3O_8.

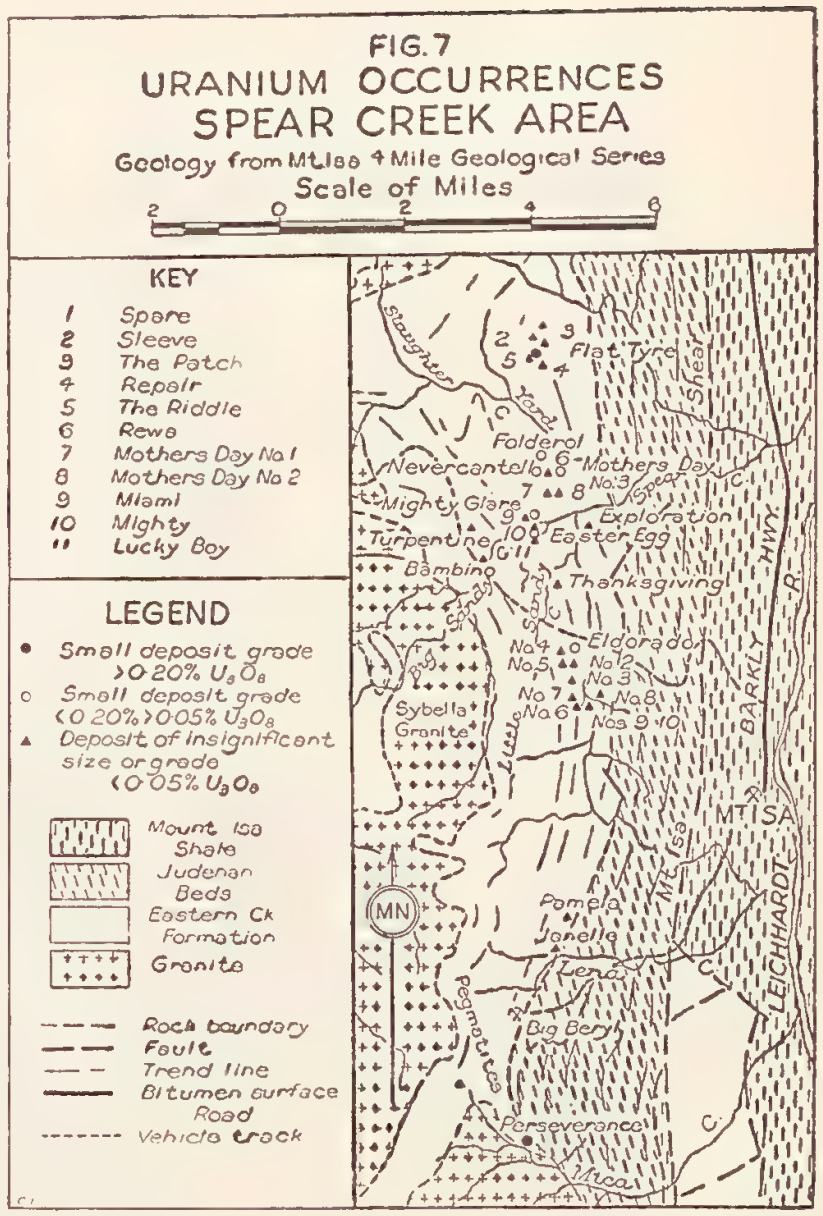
Woomera

The *Woomera* lease is in the Pile sub-group, 22½ miles north of Mount Isa. Uranium mineralization extends over an area 95 feet long by 6 feet wide but the grade is only 0·013 per cent. eU_3O_8. The host rocks are hematite-stained, fine-grained quartzite and meta-siltstone.

Adjacent to the *Womera* on the north is the *Cyclotron* lease. The radioactivity on the *Cyclotron* is too weak to be of any economic significance.

SPEAR CREEK GROUP (see Fig. 7)

All the deposits in this group are included in the Easter Egg sub-type of the Eastern Creek type. The deposits occur in a succession of hornblende, biotite, allanite and quartz-mica schists. These are considered to be more highly metamorphosed equivalents of the meta-basalt with interbedded calcareous and arenaceous



meta-sediments which occur in the Calton Hills–Paroo Creek areas. Uraninite has been determined in ore from the *Flat Tyre* deposit and doubtfully in ore from the *Easter Egg* deposit, but elsewhere the identity of the primary uranium mineral is not known.

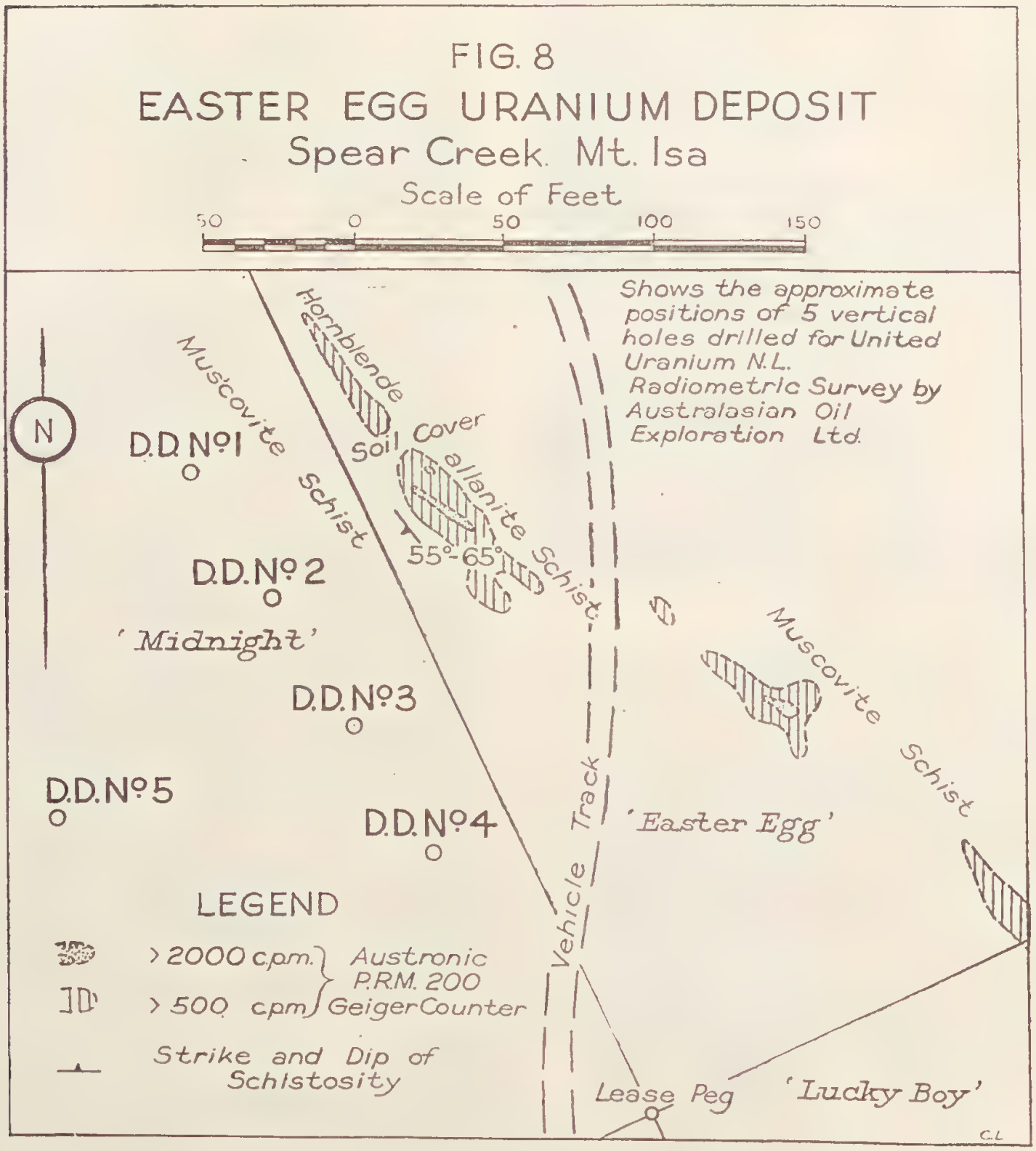
Bambino

This lease is situated near the old May Downs track, 6 miles north-west of Mount Isa. Several small uranium deposits occur on the lease and the average grade of these is 0·062 per cent. eU_3O_8. The deposits were costeaned and sampled by Mount Isa Mines Ltd.

Easter Egg

Location : 5 miles north-west of Mount Isa and 1½ miles north of the turnoff from the old May Downs track.

The uranium mineralization occurs in quartz-allanite schist and hornblende schist which are interbedded with muscovite schist and quartzite. Some quartz and calcite have been introduced and some copper-staining is also present. Coatings of a yellow uranium mineral on joint planes have been determined as carnotite. The primary uranium mineral is probably uraninite, but positive identification has not been possible. The schists range in strike from N. 45 deg. W. to N. 36 deg. W. and the dip is to the west at 55 deg. to 65 deg.



Several radioactive anomalies occur on this lease (see Fig. 8). The main anomaly is 110 feet long by 8 feet wide but included in this is a soil-covered area 10 feet long which may represent a break in the lode. Smaller anomalies occur to the south-east of the main anomaly and the largest of these is 40 feet long and 7 feet wide. There may be a faulted relationship between the main anomaly and the south-eastern anomalies. The grade at the surface calculated from a limited number of costean samples taken by Australasian Oil Exploration Ltd., is 0·18 per cent. U_3O_8. However, the width and grade of the uranium mineralization is very erratic and assay data must be regarded with some caution.

The *Midnight* lease is adjacent to the *Easter Egg* on the west and the deposits which crop out on the *Easter Egg* pass into the *Midnight* lease at a depth of 50 feet to 100 feet. Test drilling was carried out on the *Midnight* by United Uranium N.L. Two of the four drill-hole intersections at a depth of approximately 100 feet were of significant width and grade and the intersection at a depth of 233 feet–240 feet was also of a grade comparable with that at the surface. The deposit has not been fully tested but there appears to be some possibility of small scale, selective mining being carried out on an economic basis. The original *Easter Egg* and *Midnight* leases were taken up in 1959 as the *Citation* lease.

TABLE 3—DIAMOND DRILLING DATA: MIDNIGHT LEASE (supplied by United Uranium N.L.)

D.D. No.	Location	Total Depth	Declination	Lode Intersection	True Width	Grade U_3O_8
		Feet		Feet	Feet	
1	15 ft. west of Easter Egg boundary opposite the northern end of the main anomaly	150	Vertical ..	72–79 89–94	3½ 2½	Not assayed. Weakly radioactive
2	50 ft. south-east of D.D. No. 1. Opposite the most highly radioactive section of the outcrop	185	Vertical ..	66–86	10	0·29% (chemical)
3	50 ft. south-east of D.D. No. 2. Opposite the southern end of the main anomaly	204	Vertical ..	84–102 124–129 134–137	9 2½ 1½	0·26% (chemical) } Weakly radioactive
4	50 ft. south-east of D.D. No. 3. Opposite small, irregular anomalies	180	Vertical ..	102–110 114–118 140–142 147–149	4 2 1 1	0·16% eU_3O_8 } Weaker radioactivity. Not assayed
5	Approximately 100 ft. south-west of point midway between D.D. Nos. 2 and 3	349	Vertical ..	233–240 260–265	3½ 2½	0·25% eU_3O_8 Not assayed

Eldorado Nos. 1–10

Location: The leases extend in a north-south belt for over a mile south of the old May Downs track near Draper's farm. They are 3½ miles west-north-west of Mount Isa.

The rock succession consists of hornblende-allanite schist, Mica schist and quartzite and the uranium mineralization is confined to the hornblende-allanite schist. The strike is north-north-west and the dip is steeply to the west. Strong folding and strike faulting has affected the schists. Some coatings of a yellow-green uranium mineral occur in the more highly radioactive sections.

On the *Eldorado No.* 1 a radioactive anomaly near the northern end of the lease is 60 feet long and 6 feet in width. The average of two assays of representative samples was 0·19 per cent. U_3O_8. Some costeaning was carried out by Australasian Oil Exploration Ltd. but soil cover obscures the full extent of this anomaly. Towards the southern end of the lease, weak radioactivity can be traced over a length of 300 feet but this is of little significance.

Eldorado No. 2 is adjacent to *Eldorado No.* 1 on the south. Uraniferous hornblende-allanite schist is exposed over a length of 30 feet and a width of 1½ feet. The intensity of radioactivity is not as high as on *Eldorado No.* 1.

Eldorado No. 3 is adjacent to *Eldorado No.* 2 on the south. The radioactivity is much weaker and more restricted in extent than that on *Eldorado No.* 2 and it is not considered to be of any economic significance. Similarly, the radioactivity on *Eldorado No.* 4 and 5 which are located to the west of *Eldorado Nos.* 1 and 2 is of no significance.

Eldorado No. 6 is adjacent to *Eldorado No.* 3 on the south. Radioactivity can be traced discontinuously over a length of 300 feet, and a maximum width of 3 feet. The intensity of radioactivity is weak except for isolated points of strong intensity. Some copper-staining is associated with the uranium mineralization. The uraniferous schists on *Eldorado Nos.* 1–3 and 6 are at approximately the same horizon in the succession.

On *Eldorado No.* 7 which is adjacent to *Eldorado No.* 6 the strike of the schists is N. 2 deg. W. and weak radioactivity is restricted to small infrequent outcrops over a length of 100 feet.

EldoradoNos. 8–10 are a little to the south-east of the other Eldorado leases and contain small areas of weak radioactivity. Discontinuous, weak radioactivity occurs over a length of 100 feet and a maximum width of 1½ feet on *Eldorado No.* 8. On *Eldorado No.* 10 weak radioactivity extends over 100 feet and to a maximum width of 5 feet.

Exploration No. 1

Location: 7 miles north-west of Mount Isa and ¾ mile easterly from the *Easter Egg.*

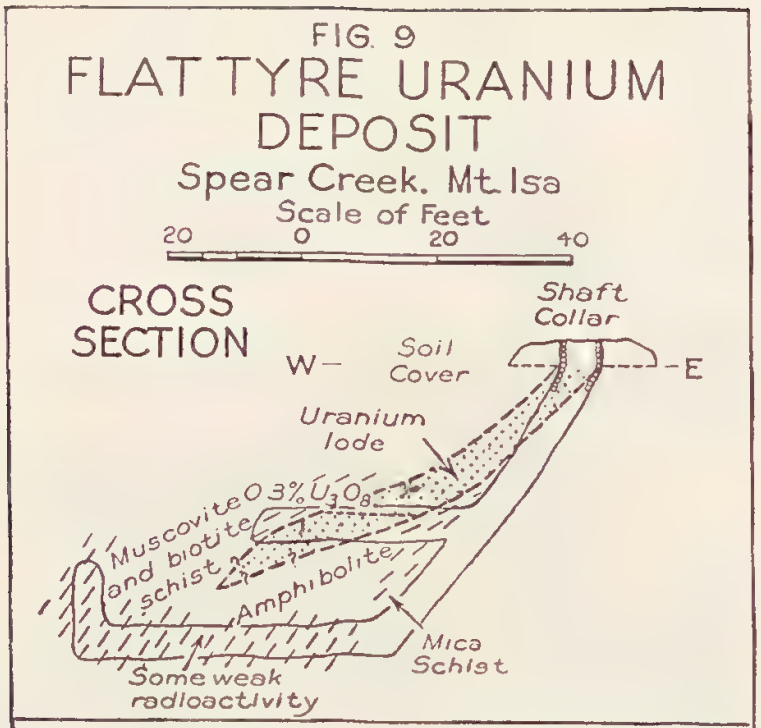
The pattern of radioactivity is similar to most other deposits in the area—weak average intensity with a few small areas of strongly radioactive material. The strike is N. 7 deg. E. and the dip is steeply to the west. A vertically-dipping quartz vein occurs 40 feet west of the radioactive anomaly and this may have some effect on the uranium lode at depth.

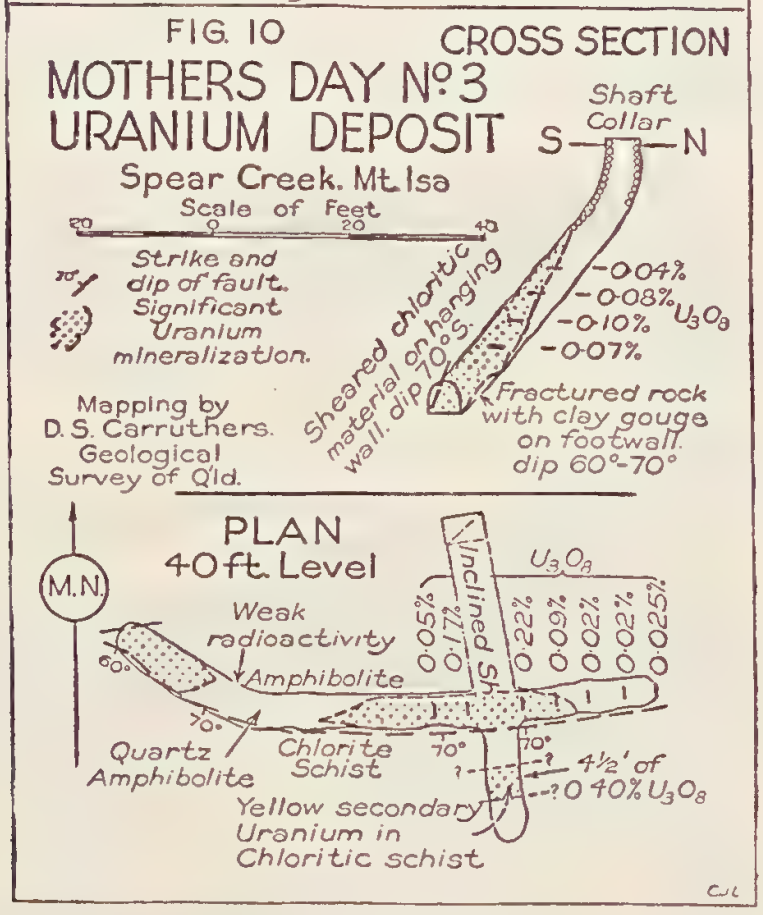
Flat Tyre

Location: 7 miles north-north-west of Mount Isa and 2 miles north-north-west of the *Mother's Day No.* 3 lease.

The uranium mineralization occurs in a silicified allanite hornblendite which is in a succession of muscovite, biotite and chlorite schist and amphibolite. Uraninite occurs as aggregates of very fine grains. Magnetite, hematite and sphene are minor constituents of the hornblendite. Coatings of a yellow-green uranium mineral occur frequently on joint planes in the highly radioactive lode material. The strike of the hornblendite ranges from north-east to north and the dip is 60 deg. to 70 deg. westerly. Local flattening of the dip indicates flexuring in the schists.

United Uranium N.L. explored the deposit by means of trenches, costeans and a prospecting shaft with crosscuts. Uranium mineralization extends over a





total length of 170 feet but the main ore-shoot is 60 feet long and 4 feet wide. A lode intersection in a crosscut from the prospecting shaft at a depth of 32 feet assayed 0·30 per cent. U_3O_8 (chemical) over a true width of 4 feet (see Fig. 9). However, no significant radioactivity was intersected in a crosscut at a depth of 50 feet. This indicates either that the ore-shoot pinches out between the levels or that it pitches away to the north or south. Further exploration is required to clarify the position.

The *Patch*, *Repair*, *Riddle*, and *Sleeve* leases are in the neighbourhood of the *Flat Tyre*. A considerable amount of costeaning to remove soil cover was carried out on the leases but no significant radioactive anomalies were exposed.

Folderol Nos. 1–3

These leases are situated 6 miles north-west of Mount Isa in the *Mother's Day–Flat Tyre* sub-group. They were mapped and sampled by Mount Isa Mines Ltd. On *Folderol No.* 1 lease there is a deposit containing 25 tons per vertical foot with a surface grade of 0·09 per cent. eU_3O_8 and on the *Folderol Nos.* 2 and 3 leases there are deposits containing 25 tons per vertical foot with a surface grade of 0·19 per cent. eU_3O_8.

Janelle

Location: Approximately 1 mile northerly from the *Big Beryl* mine and 5 miles south-west of Mount Isa.

The uranium mineralization on the *Janelle* is in the same belt of schists in which the *Eldorado*, *Easter Egg*, and other deposits occur further to the north. Finely-disseminated uraninite occurs in a fine-grained amphibolite. Mica schists with large quartz lenses, pegmatites and greisen also crop out on the lease which is near the northern limit of the Mica Creek pegmatite area. The schists strike N. 5 deg. W. and dip west at 60 deg. to 70 deg. Weak copper mineralization is associated with the uraniferous amphibolite in part. The amphibolite occurs in narrow lenses in a fold structure. The lease was costeaned and sampled by Mineral Ventures N.L. The highest of 6 assay results was 0·225 per cent. eU_3O_8 but the grade is less than 0·10 per cent. U_3O_8.

Lucky Boy

This lease is adjacent to the *Easter Egg* on the south. Some very weak radioactivity occurs on approximately the same line of strike as the anomalies on the *Easter Egg*. Costeaning was carried out by United Uranium N.L. without exposing any significant uranium mineralization.

Lucky Break

This lease is situated between the *Easter Egg* and *Mother's Day* leases. Small amounts of a yellow-green uranium mineral are visible in the outcrop. The host rock is a calcareous quartz schist which occurs in a succession of mica and amphibolitic schist. Some areas of intense radioactivity up to 2 feet in width are known to occur but the overall radioactivity is weak.

Miami

A radiometric anomaly on this lease represents a continuation of the anomaly on the *Mighty Glare* lease. The part of the anomaly on the *Miami* is weakly radioactive and adds little to the importance of the deposit on the *Mighty Glare*.

Mighty

The *Mighty* is situated adjacent to the *Easter Egg* on the north. The lease area is largely soil-covered and some costeaning was carried out by Australasian Oil Exploration to test the possibility of the occurrence of further anomalies along the line of lode of the *Easter Egg* deposits. However, only weak radioactivity was located.

Mighty Glare

Location: 5 miles north-west of Mount Isa and ¼ mile north-north-west of the *Easter Egg*. The *Mighty* lease is adjacent to the south.

There is a radioactive anomaly 170 feet long and 12 feet wide. The anomaly strikes N. 34 deg. W. and dips south-westerly. Mount Isa Mines Ltd. mapped and sampled the deposit and estimated it to contain 130 tons per vertical foot of ore with a surface grade of 0·08 per cent. eU_3O_8. The highest assay was 0·21 per cent. eU_3O_8 over a width of 22 feet.

Mother's Day Nos. 1–3

Location : 5 miles north-north-west of Mount Isa and 1 mile north-north-east of the *Easter Egg*.

On the *Mother's Day Nos.* 1 and 2 leases the uranium mineralization is in calc-silicate schist which occurs within mica schists. Radioactivity extends for a length of over 150 feet but the width is narrow and irregular, and the intensity of radioactivity is weak. A little copper-staining is associated with the uraniferous schist. Some bulldozing has been carried out to remove soil cover.

Mother's Day No. 3 is a short distance north-east of the No. 1 and No. 2 leases. The uranium mineralization occurs in amphibolitic schist in a succession of mica and chlorite schist. Amphibolite dykes also crop out on the lease. The regional strike is north-westerly but the uranium is associated with an anticlinal area of a fold which pitches southerly at 70 deg. The schistosity in the vicinity of a prospecting shaft strikes roughly east-west. Radioactivity is mainly confined to an anomaly 70 feet long and 3½ feet wide. The average grade of underground samples was 0·11 per cent. U_3O_8. Assay figures ranged from 0·02 per cent. U_3O_8 to 0·40 per cent. U_3O_8 which gives an indication of the irregular nature of the uranium mineralization. The 0·40 per cent. U_3O_8 assay was from a width of 1 foot of sheared, chloritic schist on the hanging-wall of the main deposit on the 40 feet level and the high uranium content is attributed to the presence of a yellow, secondary uranium mineral.

Costeaning and underground exploration on the lease was carried out by United Uranium N.L. An inclined shaft was sunk to a vertical depth of 40 feet and a crosscut south, and drives east and west, were extended from the base of the shaft (see Fig. 10). The assay values deteriorated as the lode was followed in drives easterly and westerly towards the limbs of the fold structure. Some small-scale, selective mining of the deposit may be possible but the erratic lode width and grade would create serious difficulties to development on an economic basis.

Nevercantell

This lease is situated to the west of the *Mother's Day No.* 3 and is 6 miles north-west of Mount Isa. A small uranium deposit on the lease was mapped and sampled by Mount Isa Mines Ltd. and was estimated to contain 35 tons per vertical foot of ore with a surface grade of 0·20 per cent. eU_3O_8.

The *Rewa* lease is situated near the *Nevercantell* and to the west of the *Mother's Day No.* 3. It was costeaned but no significant radioactivity was exposed.

Pamela

Location : ¾ mile north of the *Janelle* and 5 miles south-west of Mount Isa.

The geology is very similar to that described for the *Janelle* lease. There are two radiometric anomalies on the lease. The northern anomaly is 30 feet long by 10 feet wide and the southern anomaly is 100 feet long by 80 feet wide. Costeaning and sampling were carried out by Mineral Ventures N.L. The highest of 30 assay results was 0·394 per cent. U_3O_8 but the grade is less than 0·10 per cent. U_3O_8.

Perseverance

Location : 7 miles south-south-west of Mount Isa and 2 miles south of the *Big Beryl* mine.

This deposit occurs in the same northerly trending belt of hornblende and biotite schists as the mica, beryl, monazite, cassiterite and tantalite pegmatites of the Mica Creek area. Coarse gneissose granite crops out about 200 yards to the west. Uranium mineralization is confined to a folded horizon of amphibolite. The structure is not well-defined owing to the rather massive nature of the host-rock but the high grade ore appears to be associated with the nose of a north pitching synclinal structure and lower grade ore occurs along the eastern limb of the fold. Radioactivity occurs over a length of 160 feet and an average width of 5 feet but uranium mineralization of economic interest is more restricted in extent and contains 65 tons per vertical foot with a grade of 0·22 per cent. U_3O_8. Five bulldozed costeans were put in by Mount Isa Mines Ltd. and systematic sampling was carried out. The original lease lapsed and the area was taken up in 1959 as the *Emancipation No.* 1 lease. Pits were sunk in the high grade ore at the southern end of the deposit. Samples from these pits were reported to assay 1·16 per cent. U_3O_8 and 0·42 per cent. U_3O_8. This high grade ore consists of a dense hornblendite rock containing some allanite and iron oxide minerals. Some coatings of a yellow, fluorescent uranium mineral are present on some joint planes.

Thanksgiving

This lease is located 4 miles north-west of Mount Isa and less than 1 mile south of the *Easter Egg*. The original lease lapsed and it was taken up as the *Dalveen* in 1959. Radioactivity occurs principally in an anomaly 40 feet long and 2½ feet wide. The strike is N. 50 deg. W. and the dip is 69 deg. to the south-west. The overall intensity of radioactivity is weaker than that on the *Easter Egg*. Amphibolitic schist constitutes the host rock. Some costeaning has been carried out to remove soil cover. A selected sample assayed 0·40 per cent. U_3O_8.

Turpentine

Location : Adjacent to the old May Downs track, 6 miles north-west of Mount Isa.

The geology of the deposit on this lease is typical of deposits of the Easter Egg type. Small areas of intense radioactivity are erratically dispersed within areas of weak radioactivity which extend discontinuously over a length of 600 feet. The area sampled by Mount Isa Mines Ltd. may contain 110 tons per vertical foot with a grade of 0·042 per cent. eU_3O_8.

Wotan

The *Wotan* lease is located in the *Easter Egg–Flat Tyre* area, 6 miles north-west of Mount Isa. The uranium mineralization on the lease is typical of the Easter Egg type of deposit. No details of the extent and grade of the deposit are available but the intensity of radioactivity indicates that preliminary testing by mapping and sampling is warranted.

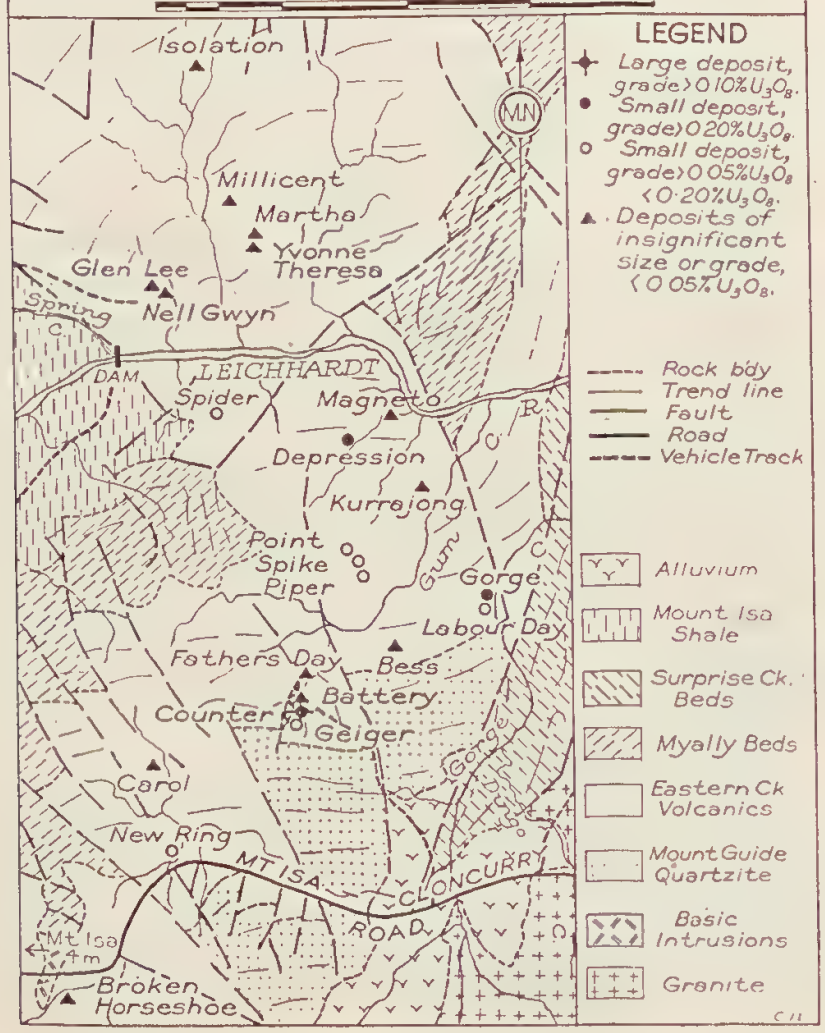
GORGE CREEK GROUP (see Fig. 11)

All the deposits in this group are assigned to the Counter or Skal sub-type of the Eastern Creek deposits. The identity of the primary uranium mineral has not been definitely determined.

Battery

The *Battery* lease is adjacent to the *Counter* lease on the north, 9 miles north-east of Mount Isa. The host rock is hematite-stained, calcareous quartzite. Two radioactive anomalies occur along a roughly east-west line of strike. They are 30 feet long and 7 feet wide and 20 feet long by 2 feet wide. No assay data are available but the overall intensity of radioactivity is weak and is in no way comparable with that in the *Counter* deposit. Three costeans were excavated by Australasian Oil Exploration Ltd.

FIG. 11
URANIUM OCCURRENCES
GORGE CREEK AREA
Geology from Cloncurry 4 Mile Geological Series
Scale of Miles
2 0 2 4 6



Bess

Location : 2 miles north-east of the *Counter* and 11 miles north-east of Mount Isa.

Uranium mineralization is confined to lenses of impure, calcareous quartzite and siltstone interbedded with meta-basalt. Calcite veins are of frequent occurrence and minor amounts of chalcopyrite occur sporadically in the rocks in the vicinity of the radioactive anomalies. The area is extensively faulted and fractured. Radioactivity occurs sporadically and discontinuously over a total length of 1,500 feet. There is no well-defined uranium deposit and the overall intensity of radioactivity is weak. A grab sample assayed 0·41 per cent. U_3O_8 but this is not indicative of the grade of the deposit. The *Bess* was taken up as the *Napo* when the original lease lapsed.

Broken Horseshoe

This lease is situated a short distance south of the Mount Isa–Cloncurry road, 4½ miles east of Mount Isa. Weak radioactivity extends over a length of 800 feet. Assays of 24 samples taken by Mineral Ventures N.L. ranged from 0·006 per cent. to 0·081 per cent. U_3O_8.

Carol

Location : 7 miles east-north-east of Mount Isa and 2 miles west-south-west of the *Counter*.

Uranium mineralization occurs in a quartz-magnetite greywacke which is interbedded with meta-basalt and quartzite. The strike of the lode is N. 75 deg. E. and the dip is steeply to the north. The lode appears to be terminated by faults which strike N. 20 deg. W. It is 74 feet long by 9 feet wide and the surface grade is 0·04 per cent. U_3O_8.

Counter (Anderson's lode)

Location : 9 miles north-east of Mount Isa and 3 miles north of the Mount Isa–Cloncurry road.

The rock succession in the area consists of sheared and chloritized basalt with some interbedded quartzite, meta-greywacke and volcanic conglomerate. Fine to medium-grained basic dykes intrude the succession. Epidote and calcite are fairly widely distributed in association with joints and faults.

The host rock is a cross-bedded, magnetite greywacke which forms a lenticular horizon in the Eastern Creek succession. It has undergone low grade metamorphism and carbonatization. The main constituent minerals are quartz, chlorite, biotite and plagioclase, and the minor constituents include muscovite, apatite, zircon and sphene. Secondary calcite is abundant. The opaque constituents are magnetite with some pyrite, hematite, ilmenite and rutile. The primary uranium mineral has not been determined but it is finely disseminated and occurs in association with sphene, rutile and biotite (*see* section on Primary Uranium Minerals). There is a gradation from greywacke to quartzite in parts of the orebody but the quartzite is usually weakly uraniferous or barren.

The strike of the bedding is N. 85 deg. W. and the dip is to the north at 70 deg. Strike faults occur on the northern and southern margins of the meta-greywacke

lens and the northern fault marks the hanging-wall of the orebody along part of its length (see Fig. 12). The footwall of the orebody is not as well-defined and there is usually an appreciable thickness of unmineralized or weakly mineralized greywacke between the footwall of the orebody and the southern margin of the greywacke horizon. Northerly-striking, transverse faults bear an important relation to the eastern and western limits of uranium mineralization. Along these transverse faults dolerite dykes have been intruded. The dykes are similar in composition to the adjacent meta-basalts of the Eastern Creek Volcanics but can usually be distinguished by difference in texture. On the west the orebody abuts the faulted contact of the meta-greywacke with a meta-dolerite dyke. The contact dips east at approximately 65 deg. On the east a small section of mineralized meta-greywacke is separated from the main section of the outcropping orebody by a highly fractured, meta-dolerite dyke. The dyke dips east at 56 deg. whereas the orebody pitches east at approximately 65 deg. so that the dyke passes out of the orebody at a relatively shallow depth. It appears likely that the faults provided channelways for the introduction of uranium mineralization. The adjacent greywacke was a more hospitable host rock for uranium deposition than the interbedded volcanics. Dolerite dykes were evidently intruded after the introduction of uranium mineralization. Some very weak radioactivity is associated with fractures and joints in the dolerite adjacent to the mineralized meta-greywacke but this is attributed to the movement of uranium in ground water solutions.

In outcrop the main section of the orebody is 150 feet long and 55 feet wide. The small section of the mineralized meta-greywacke on the eastern side of the meta-dolerite dyke is 30 feet long by 18 feet wide. The overall grade is approximately 0·19 per cent. U_3O_8. From the surface dimensions the main ore-shoot is estimated to contain 650 tons per vertical foot. However, diamond drilling has indicated that the tonnage of ore increases in depth and the ore-shoot contains over 1,000 tons per vertical foot from a depth of 100 feet to 400 feet. Below a depth of 400 feet the ore-shoot decreases in width and grade but the uranium mineralization increases in length towards the east and a new ore-shoot has been located to the east and to the footwall of the ore-shoot which has been followed down from the outcrop. The outcropping ore-shoot and the eastern footwall ore-shoot appear to be linked by an attenuated section of weak mineralization. The extent of the eastern footwall ore-shoot is not known but it has been intersected from depths of 555 feet to 963 feet and the width and grade are comparable with the outcropping ore-shoot. Reserves of 0·19 per cent. U_3O_8 exceeding a half a million tons have been proved in the outcropping ore-shoot and there are good prospects that reserves to a depth of 1,000 feet will exceed 1,000,000 tons when the present drilling programme is completed.

The initial exploration of the deposit was carried out by Australasian Oil Exploration Ltd. who drilled 8 holes totalling 2,480 feet. Queensland Mines Ltd. have completed an additional 16 holes totalling more than 12,270 feet and two drill holes are in progress (September, 1959).

FIG. 12

COUNTER URANIUM DEPOSIT
MOUNT ISA

Based on mapping by D. Burger.
Australian Oil Exploration Ltd

Scale of Feet
50 0 50 100 150

LEGEND

- Meta-basalt.
- Meta-dolerite.
- Medium grained basic dyke.
- Rock or lode bdy.
- 65° Strike and dip of bedding
- Outcrop of orebody.
- Extent of orebody defined by costeans.
- Meta-greywacke with some quartzite and pebble beds.
- 70° Fault or joint showing dip.

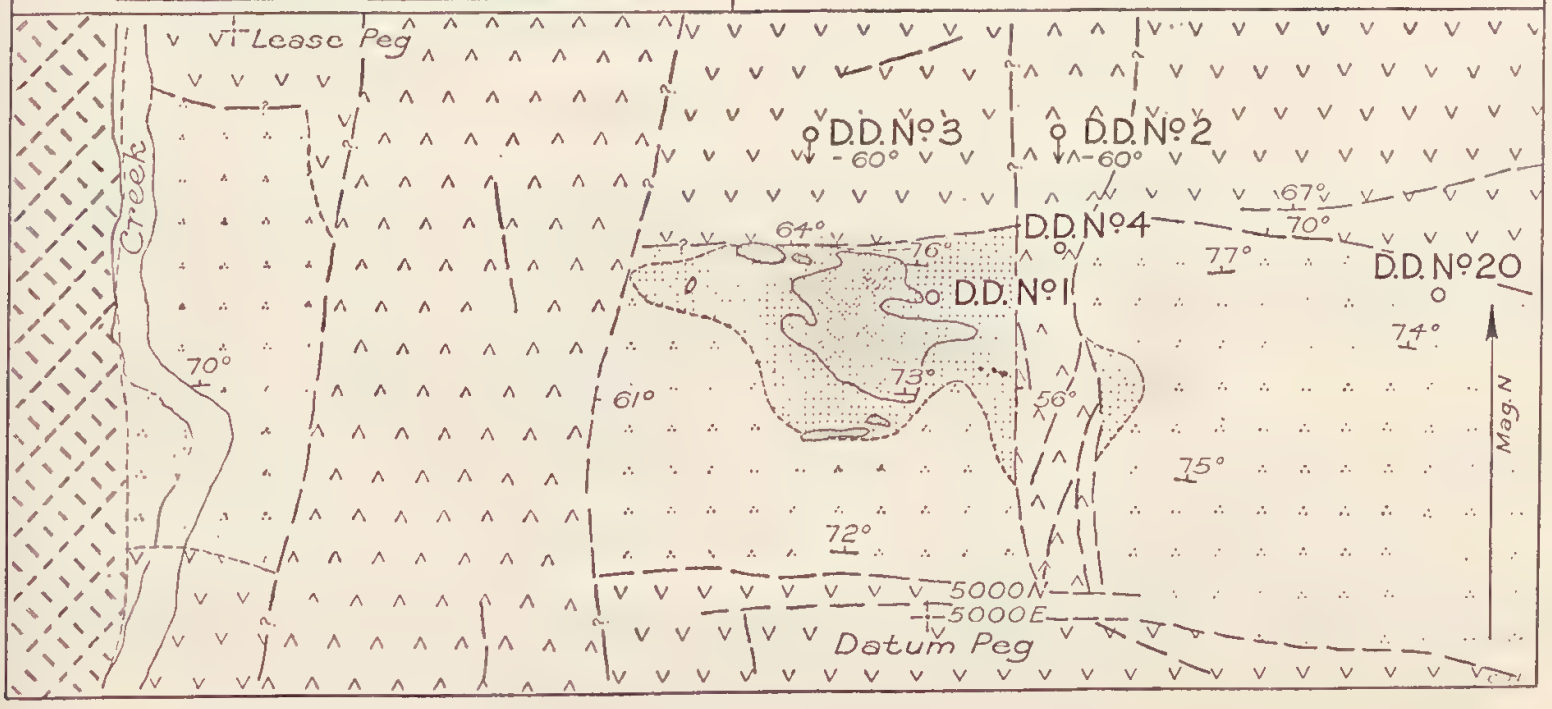


TABLE 4.—DIAMOND DRILLING DATA: COUNTER (ANDERSON'S LODE)*

D.D. No.	Location	Attitude	Total Depth	Lode Intersection	% U_3O_8
1	5125N. 5002E.	Vertical	224′ 6″	0′–185′ (185′)	0·202
2	5190N. 5050E.	60°S.	243′ 4″	65′–200′ (135′)	0·177
3	5190N. 4950E.	60°S.	127′	52′ 6″–117′ 6″ (65′)	0·202
4	5145N. 5050E.	Vertical	327′ 6″	25′ 6″–180′ (155′ 6″) 207′–307′ 6″ (100′ 6″)	0·22 0·13
5	5265N. 5100E.	60°S.	314′	175′–278′ 9″ (103′ 9″)	0·18
6	5265N. 5100E.	80°S.	399′ 5″	250′–382′ (132′)	0·19
7	5265N 5000E.	80°S.	320′ 2″	247′–259′ (12′)	0·08
8	5320N. 5150E.	80°S.	523′	341′ 8″–346′ (4′) 394′–509′ (115′)	0·14 0·185
9	5320N. 5070E.	78°S.	517′	24′–30′ (6′) 300′–376′ (76′)	0·12 0·188
10	5320N. 5230E.	80°S.	575′	371′–437′ (66′) 537′–548′ (11′)	0·193 0·162
11	5430N. 5230E.	80°S.	720′	565′–597′ (32′) 597′–637′ (40′)	0·025 0·21
12	5430N. 5170E.	80°S.	627′	540′–611′ (71′)	0·18
13	5430N. 5310E.	80°S.	749′	556′–561′ (5′) 640′–645′ (5′) 678′–684′ (6′)	0·15 0·095 0·14
14	5530N. 5310E.	82°S.	905′	849′–859′ (10′)	0·095
15	5530N. 5390E.	85°S.	1,004′	777′–787′ (10′) 787′–792′ (5′)	0·06 0·105
16	5530N. 5470E.	83°S.	1,003′	950′–953′ (3′)	0·155
17	5430N. 5390E.	85°S.	822′	625′–755′ (130′)	0·20
18	5578N. 5530E.	85°S.	1,138′	No lode intersection	..
19	5531N. 5310E.	62°S.	631′	532′–542′ (10′) 602′–616′ (14′)	0·117 0·114
20	5145N. 5230E.	Vertical	291′	No lode intersection	..
21	5430N. 5450E.	85°S.	859′	624′–632′ (8′) 750′–846′ (96′)	0·09 0·106
22	5370N. 5370E.	80°S.	769′	555′–666′ (111′)	0·249
23	5429N. 5510E.	85°S.	984′	928′–944′ (16′)	0·04
24	5381N. 5369E.	78°S.	672′	635′–672′ (37′)	0·137

* Data supplied by Australasian Oil Exploration Ltd. and Queensland Mines Ltd.

Depression

This deposit is situated a mile south of the Leichhardt River and 12 miles north-east of Mount Isa. The radioactive anomaly is 165 feet long by 3 feet wide and the grade is 0·37 per cent. eU_3O_8. It was mapped and sampled by Mount Isa Mines Ltd. There are good prospects of development on a small scale if treatment facilities become available. On the adjacent *Big Dip* lease there is a radioactive anomaly 70 feet long by 2 feet wide and of comparable grade.

Father's Day

The *Father's Day* is adjacent to the *Battery* on the north. A radioactive anomaly on the lease strikes N.5 deg. E. which is parallel to one of the principal fault directions in the area and almost at right angles to the strike of the bedding in the Eastern Creek succession. Radioactivity of comparatively weak intensity occurs over a length of 55 feet and a width of 4 feet. It was not considered to be of any economic significance.

Geiger

Location : ½ mile south of the *Counter* lease and 9 miles north-east of Mount Isa.

Radioactivity occurs in lenses of hematite-stained, calcareous quartzite which strike N. 85 deg. W. and dip 70 deg. to 80 deg. N. The largest lens is the most westerly one and this has a length of 85 feet and a width of 9½ feet. The grade indicated by the assay of two representative samples is 0·13 per cent. U_3O_8. The other lenses are 78 feet long by 6½ feet wide and 43 feet long by 6½ feet wide but judging by the intensity of radioactivity these lenses are of considerably lower grade than the western lens.

Glen Lee

This is one of a small group of leases situated 12 miles north-north-east of Mount Isa and 1 mile north of the Leichhardt River. A number of small, irregular radioactive anomalies exhibiting weak overall radioactivity occur in a rock succession consisting of chloritized basic volcanics with some interbedded arenaceous meta-sediments. The *Nell Gwyn* lease is in the *Glen Lee* group but no significant radioactivity has been located on this lease.

Gorge

Location : 12 miles north-east of Mount Isa and 3 miles east-north-east of the *Counter*. Gorge Creek is a short distance away to the east.

The *Gorge* and the adjacent *Labour Day* lease to the south are situated in a heavily faulted area. The regional strike is approximately east-west but the bedding on these leases strikes N.5 deg. W. (cf. *Father's Day*). A major north-north-westerly striking fault occurs to the east of the leases and this fault appears to be responsible for the anomalous strikes. Uranium mineralization is confined to a hematite-stained, calcareous quartzite. Lenses of uraniferous quartzite extend over a length of 160 feet. The main lens is 42 feet long and 5 feet wide. The grade indicated by the assay of two representative samples is 0·21 per cent. U_3O_8.

Radioactivity on the *Labour Day* lease occurs on the same line of strike as that on the *Gorge* and has a total length of 66 feet. Significant radioactivity is restricted to a length of 40 feet and a width of 3½ feet. One representative sample assayed 0·06 per cent. eU_3O_8. The *Labour Day* and *Gorge* leases were taken up as the *Lolo* when the original leases lapsed.

Isolation

This is the most northerly of the Gorge Creek group of deposits. It is 16 miles north-north-east of Mount Isa. A radioactive anomaly on the lease is 80 feet long by 22 feet wide and has a grade of 0·022 per cent. eU_3O_8. It was mapped and sampled by Mount Isa Mines Ltd.

Kurrajong

The *Kurrajong* is situated 12 miles north-east of Mount Isa and 4 miles north-east of the *Counter*. Comparatively weak radioactivity occurs in small lenses of arenaceous meta-sediments which strike east-west.

Lindsay

This lease is ½ mile north-west of the *Yvonne Theresa* and 14 miles north-east of Mount Isa. The geology and uranium mineralization is similar to that on the *Yvonne Theresa*. Radioactivity can be traced over a total length of 300 feet but the width is quite narrow. A yellow, secondary uranium mineral has been observed at the surface.

Magneto

The small radioactive anomaly on this lease was mapped and sampled by Mount Isa Mines Ltd. It is near the *Depression* lease, 13 miles north-east of Mount Isa. A radioactive anomaly on the lease is estimated to contain 80 tons per vertical foot with a surface grade of 0·005 per cent. eU_3O_8.

Millicent Martha

Location : 1½ miles west of the Glen Lee group and 14 miles north-east of Mount Isa.

The host rock is a calcareous quartzite impregnated with hematite, and a yellow, secondary uranium mineral, possibly autunite, has been observed at the surface. Discontinuous lenses of radioactivity occur over a length of 800 feet but the main anomaly is 37 feet long by 15 feet wide. Even in this anomaly the surface radioactivity is comparatively weak. Of 36 samples which were radiometrically assayed, the highest result was 0·285 per cent. U_3O_8 and the average grade is probably well below 0·05 per cent. U_3O_8. The strike of the bedding is N.30 deg. W. and the dip is steeply to the north-east. One diamond drill hole was put down by Mineral Ventures N.L. to test the primary mineralization but no significant intersection of uranium ore was obtained.

New Ring

Location : 6 miles east of Mount Isa and ½ mile north of the Mount Isa–Cloncurry road.

The strike of the meta-basalt and the interbedded arenaceous meta-sediments on the lease is N.70 deg. E. and the dip is steeply to the north. There is a

General view of Mary Kathleen open-cut, 1959.

[*Photo by C. H. Shipway.*

prominent pattern of north-north-west and north-north-east-trending faults in the area and the strike of the uranium deposit corresponds to the former fault direction. Fracturing as a result of fault movements appears to have been a primary control of mineralization. A small amount of a yellow, secondary uranium mineral is present near the surface. The uranium deposit is 75 feet long and 10 feet wide. No assay data are available but the radioactivity is of relatively weak intensity and the grade is expected to be less than 0·10 per cent. U_3O_8. The deposit was costeaned by Australasian Oil Exploration Ltd.

Piper

This lease and the neighbouring *Point* lease are situated near the *Spike* which is 3 miles north-north-east of the *Counter* and 12 miles north-east of Mount Isa. Radioactivity occurs in small areas of hematite-stained, fine-grained, impure quartzite or greywacke. Magnetite and calcite are also present. On the *Spike* lease there is a radioactive anomaly 42 feet long and 10 feet wide. The strike is W. 75 deg. E. There are points of strong radioactivity within the anomaly but overall it is only of moderate intensity. A selected sample from the *Spike* assayed 0·47 per cent. U_3O_8 but this is not indicative of the grade of the deposit. The *Spike* lease was taken up as the *Rico* when the original lease lapsed.

Spider

The *Spider* lease is west of the *Depression* and 4 miles north of the *Counter*. There are four irregular areas of radioactivity on the lease. Three of these are sub-parallel and strike east-west and the fourth strikes at right angles to the other three. The most important anomaly is 2 chains long and 5 feet wide. No assay data are available.

Yvonne Theresa

This lease is adjacent to the *Millicent Martha* on the south and the geological setting is similar. Uranium mineralization occurs in discontinuous, narrow lenses of altered basalt which contain introduced quartz, calcite, hematite and magnetite. The strike of the lenses is N. 30 deg. W. to N. 15 deg. W. and they can be traced over a total length of 730 feet. Of 30 samples assayed the highest result was 0·088 per cent. U_3O_8 and the surface grade is very low. Mineral Ventures N.L. drilled one test hole but this did not reveal any improvement in the grade at depth.

MARY KATHLEEN GROUP (see Fig. 14)

Armstrong North

Location: 2½ miles east-south-east of the Mary Kathleen mine.

Uranium mineralization on this lease occurs in meta-sediments on the eastern limb of the major syncline with which the *Mary Kathleen* deposit is associated (*see* Matheson and Searl, 1956, page 534). The meta-sediments at the *Armstrong North* probably represent a lower stratigraphic horizon in the Corella Formation than those at the *Mary Kathleen*. Garnet, garnet-diopside and garnet-hematite rocks contain uranium mineralization very similar to that of the *Mary Kathleen*.

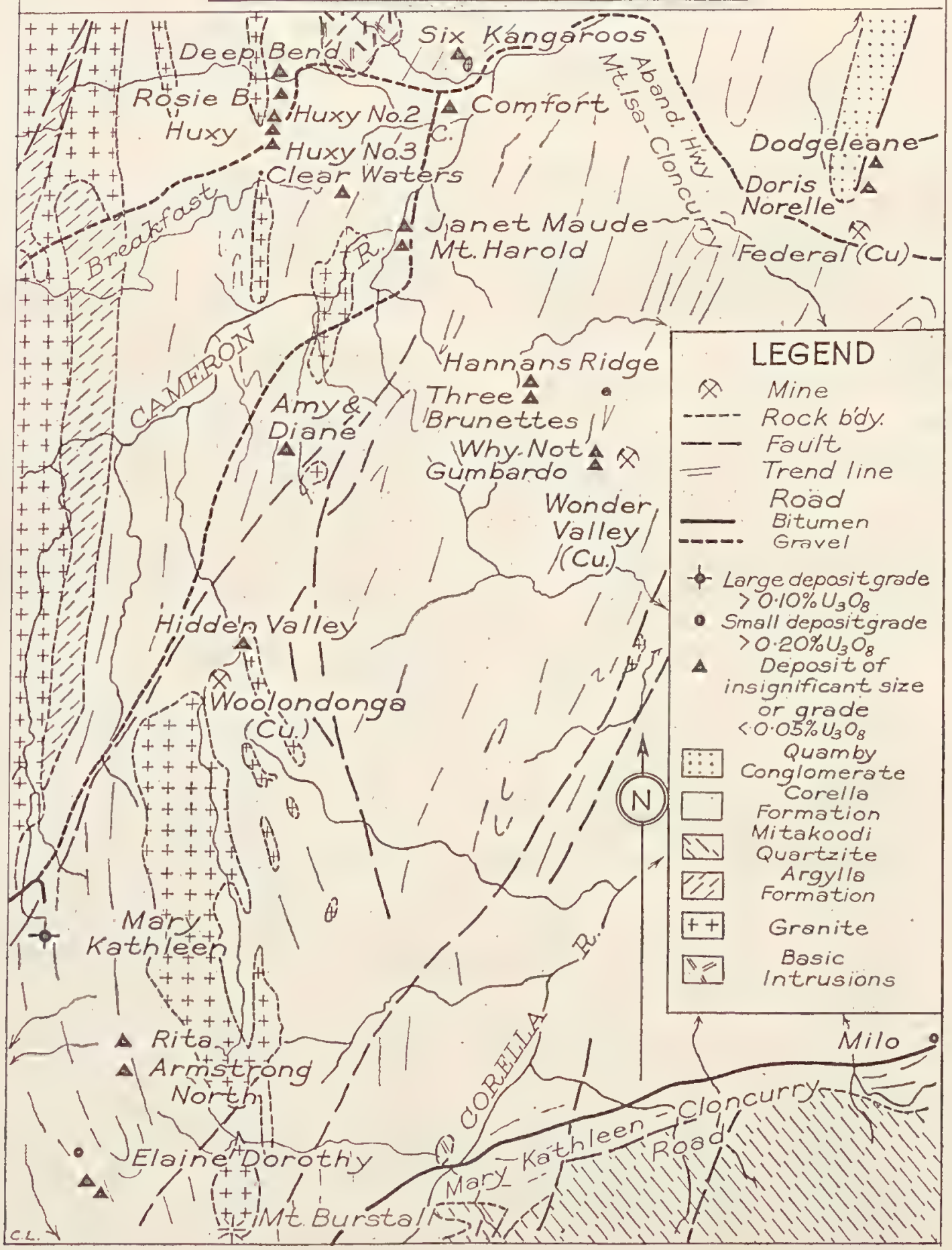
FIG. 14

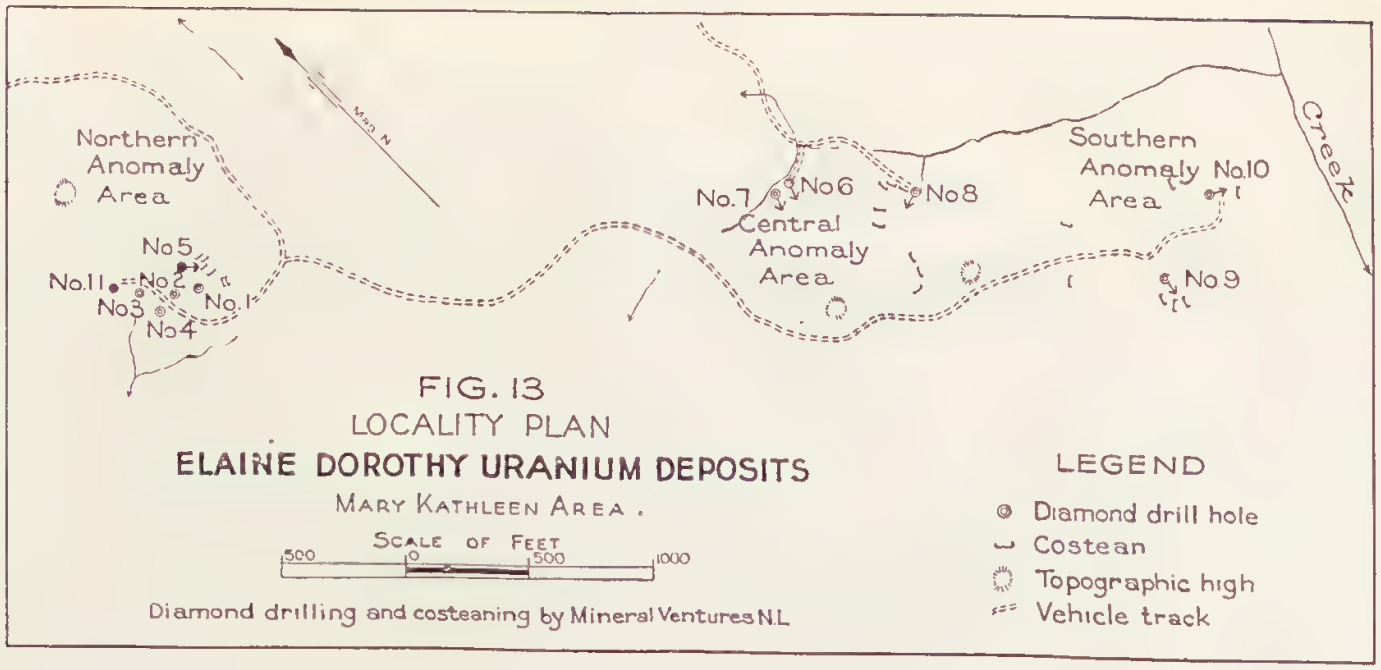
URANIUM OCCURRENCES MARY KATHLEEN AREA

Geology from Cloncurry 4 Mile Geological Series

Scale of Miles

2 0 2 4 6





Radioactivity can be traced over a length of 800 feet but significant uranium mineralization is confined to two lenticular areas. The northern lens is 200 feet long and 30 feet wide, and the southern lens is 100 feet long and 10 feet wide. The strike of the lenses is a little east of north and the dip is 70 deg. west. The intensity of radioactivity indicates that the surface grade is low. Mineral Ventures N.L. put down two diamond drill holes and the best lode intersection was 12 feet with a grade of 0·044 per cent. eU_3O_8.

Elaine Dorothy

The *Elaine Dorothy* is situated 4 miles south of the *Mary Kathleen* near the closure of a major syncline. Stratigraphically the *Elaine Dorothy* deposits are a little lower in the Corella Formation than the *Mary Kathleen*. The country rocks are diopside-scapolite granulites, impure quartzite and amphibolite. An irregular, discontinuous zone of garnetization occurs over a length of 4,500 feet and is roughly conformable with the north-westerly strike of the meta-sediments. The disposition of uranium mineralization within the garnet zone appears to be related to cross-faults and zones of fracturing. The most prominent set of faults strikes north-north-east to north-east. The finely-disseminated uranium mineral occurs in an allanite-amphibole-garnet rock and is believed to be uraninite.

Three areas of radioactivity have been tested by costeaning and diamond drilling and of these the most northerly is the only one of any economic significance (see Fig. 13). Mineral Ventures N.L. who carried out a programme of exploratory drilling estimated the ore reserves to be 5,000 tons of 0·28 per cent. U_3O_8. Of the 11 diamond drill holes put down only two had lode intersections of a grade above 0·25 per cent. U_3O_8. Although these results were disappointing the proximity and similarity of the *Elaine Dorothy* deposits to the *Mary Kathleen* may provide inducement for further exploration.

TABLE 5.—DIAMOND DRILLING DATA: ELAINE DOROTHY (supplied by Mineral Ventures N.L.)

D.D. No.	Location		Inclination and Bearing	Total Depth	Mineralization
1	9228 N. 3427 E.		Vertical	200′	Garnet zones intersected to 86′. No significant uranium intersection
2	9314 N. 3396 E.		Vertical	225′	86′–88½′ (2½′)—0·007% eU_3O_8 88½′–94′ (5½′)—0·365% eU_3O_8 94′–95′ (1′)—0·044% eU_3O_8
3	9446 N. 3398 E.	Northern radioactive anomaly	Vertical	348′	180′–208′ 6″ (28′ 6″)—0·033% eU_3O_8 208′ 6″–210′ 6″ (2′)—0·276% eU_3O_8 210′ 6″–212′ 6″ (2′)—0·006% eU_3O_8
4	9371 N. 3329 E.		Vertical	127′	69′ 9″–100′ (30′ 3″)—0·03% eU_3O_8 100′–101′ 3″ (1′ 3″)—0·187% eU_3O_8 101′ 3″–103′ 3″ (2′)—0·03% eU_3O_8
5	9281 N. 3500 E.		60° at 173°	160′	Garnet zones to 134′. No significant uranium intersection
6	6827 N. 3871 E.		45° at 278°	211′	Garnet abundant 113′–211′. No significant uranium intersection
7	6887 N. 3834 E.	Central radioactive anomaly	60° at 278°	115′	109′–111′ (2′)—0·01% eU_3O_8 111′–112′ (1′)—0·22% eU_3O_8 112′–115′ 6″ (3′ 6″)—0·02% eU_3O_8
8	6342 N. 3868 E.		50° at 310°	237′	85′–93′ slightly radioactive
9	5326 N. 3490 E.		60° at 254°	150′	No significant uranium intersection
10	5144 N. 3858 E.	Southern anomaly	60° at 156°	250′	Garnet and some slightly radioactive bands to 198′.
11	9554 N. 3419 E.	Northern anomaly	Vertical	400′	323′–329′ 6″ (6′ 6″)—0·15% eU_3O_8 344′–345′ 6″ (1′ 6″)—0·10% eU_3O_8 357′–372′ slightly radioactive

Mary Kathleen (Matheson and Searl, 1956)

The history of development and some aspects of the geology of the *Mary Kathleen* have been summarily referred to in sections of Part I and will not be repeated here. The deposit is situated 33 miles west of Cloncurry, and 36 miles east of Mount Isa. Thus it is centrally situated in the Cloncurry–Mount Isa mineral belt.

The Corella Formation in the area consists of calcareous and siliceous granulite, impure crystalline limestones, quartzite, calcareous breccias and some interbedded basic volcanics and sills. Diopside, scapolite, epidote, garnet and apatite are common mineral constituents of the granulites. Quartz veins and quartz-felspar porphyry dykes and sills are of common occurrence in the area and these appear to be associated with the Mount Burstall granite to the east of the *Mary Kathleen* (see Fig. 14). This granite ranges from a coarse-grained, microcline leucogranite to a hornblende granite. A second meridional granite body occurs to the west of the *Mary Kathleen*. It is a medium-grained, gneissic, biotite-microcline granite and was probably intruded earlier than the Mount Burstall granite.

Structurally the *Mary Kathleen* is situated on the axis of a major, north-pitching synclinal structure. The synclinal axis strikes meridionally and dips steeply to the west. The main groups of faults and joints in the area strike north-easterly, northerly and west-north-westerly. The west-north-westerly group appear to be closely related to garnetization and mineralization.

The main orebody is described by Matheson and Searl (1956) as " a large boat-shaped mass, within which mineralization occurs as a network of irregular bands that are controlled by a complicated joint pattern." The most important joint system strikes north to north-easterly and dips west at 40 deg. to 70 deg. Individual ore-shoots associated with these joints rarely exceed 100 feet in length and 10 feet in width. The eastern limit of the ore zone is marked by a prominent shear with associated sulphide mineralization. The shear strikes north to north-westerly and dips to the east. Westerly to west-north-westerly faults and joints may have an important influence on the northern and southern termination of the individual ore-shoots and the orebody as a whole.

The orebody occurs in a belt of garnet-diopside-apatite granulite. Uraninite occurs finely disseminated in the rare earth minerals allanite and stillwellite. Secondary uranium minerals occur together with uraninite to a depth of 50 feet below the surface and incipient oxidation continues to a depth of 120 feet. The uranium to thorium ratio in the deposit is approximately three to one and the uranium is in equilibrium throughout. The garnet consists chiefly of almandite with lesser quantities of andradite. Uraninite preferentially replaced the andradite.

The orebody crops out on a steep hill slope and is being open cut to a height of 250 feet above the base of the outcrop. The present rate of production is 1,000 tons of ore per day and in the two years of production to the end of 1958 some 384,173 tons of ore have been produced. In 1958, two hundred and one thousand, three hundred and forty-two tons of ore were treated for a yield of 250·8 tons of uranium oxide (U_3O_8). The limestone and manganese requirements of the treatment process are obtained from local sources of supply but the sulphur for acid production is imported.

Mount Burstall

A small occurrence of a davidite-type mineral is situated 1 mile south of Mount Burstall. The occurrence is in a succession of altered basic igneous rocks, and calc-silicate rocks adjacent to a major north-north-easterly-striking fault.

Rita

This lease with the adjacent *Rary* and *Buffer* leases is situated north of the *Armstrong North* lease and 2 miles east-south-east of the *Mary Kathleen*.

Compared with the *Mary Kathleen* area the rock succession on the *Rita* is more arenaceous and less calcareous. Garnetization is associated with a horizon of granulite. Four small, irregular garnetized areas with associated weak allanite-uraninite mineralization occur over a north-south distance of 1,300 feet. Three of these are conformable with the strike of the granulite and the fourth appears to follow a prominent fracture which strikes N50 deg. W. The grade of the more highly radioactive material is less than 0·1 per cent. U_3O_8. Five shallow diamond drill holes were put down by Rio Tinto Australian Exploration Pty. Ltd. Three of these holes obtained lode intersections ranging from 9 feet to 16 feet in length but the grade was of the order of 0·01 per cent. U_3O_8.

CAMERON–CORELLA RIVER GROUP (see Fig. 14)

With few exceptions the deposits of this group are of the davidite type and occur in the Corella Formation.

Aittola's Claim

This occurrence is located just south of the Cloncurry–Mount Isa road via the *Federal* copper mine and 16 miles west-north-west of Cloncurry. Davidite occurs as coarse, disseminated grains in an altered siliceous limestone. A small quantity of a yellow, fluorescent, uranium mineral is associated with the davidite. Radioactivity is principally confined to boulders and surface rubble in two small areas, one adjacent to the road and the second approximately ½ mile to the south.

Amy and Diane

Location : 28 miles north-west of Cloncurry and nearly 4 miles south-south-west of the *Janet Maude* lease.

Uranium mineralization occurs in a quartz-orthoclase pegmatite intruding calc-silicate rocks. Contamination of the pegmatite by calc-silicate minerals during the intrusion of the pegmatite has given rise to a marginal, hybrid pegmatite–calc-silicate rock. A davidite-type mineral and magnetite are present as irregularly-distributed, coarse grains in this hybrid rock type over an area 10 feet long and 3 feet wide. One shallow trench has been excavated.

Bill's Folly

Location : 35 miles north-west of Cloncurry.

This occurrence is located in a minor granite intrusion. Radioactivity of low intensity occurs in two areas 20 feet long by 6 feet and 9 feet by 5 feet. No uranium mineral could be identified. A sample from a shallow pothole assayed 0·04 per cent. eU_3O_8.

Bitmore

This lease is situated on the eastern side of the Cameron River to the north of the abandoned Cloncurry–Mount Isa road, 26 miles west-north-west of of Cloncurry. A davidite-type mineral has been found over a very restricted area.

Clear Waters

Location : 1½ miles south-south-east of the *Huxy* lease and 12 miles north-north-east of the *Mary Kathleen.*

Uranium mineralization occurs in massive, calcareous meta-sediments composed of albite, hornblende, calcite and hematite. Uranophane and finely-disseminated uraninite have been identified (McAndrew and Edwards, 1957). Most of the radioactive material at the surface consists of floaters but a small lode one one foot wide is exposed in the adjacent outcrop. This deposit is very small but the occurrence of uraninite makes it of more interest than the davidite deposits.

Comfort

Location : 13 miles north-north-east of the *Mary Kathleen* and 1¼ miles west-south-west of the Cameron River bore near the abandoned Cloncurry–Mount Isa road.

Pegmatites intruding biotite and hornblende schist crop out on this lease but the area is largely soil-covered. Radioactivity is associated with a narrow horizon of biotite schist adjacent to pegmatite. Four costeans were excavated to remove soil cover. Highly radioactive specimens found as floaters near the lode were identified as brannerite (Lawrence, 1955, p. 70).

Deep Bend

This lease is 1 mile north of the *Huxy* and 14 miles north-north-east of the *Mary Kathleen.* A davidite-type mineral was found as detrital grains in the soil and a yellow secondary uranium mineral occurs in a small, highly radioactive area in calc-silicate rocks.

Dodge–Leane

This lease is located 21 miles west-north-west of Cloncurry and 1½ miles north of the *Federal* copper mine. Coarse grains of a davidite-type mineral are sporadically distributed through recrystallized, impure limestone. There are three closely-spaced areas of mineralization but these would aggregate only a few square feet.

Doris Norelle

Location : 21 miles west-north-west of Cloncurry and ¾ mile north of the *Federal* copper mine.

A fine-grained, acid igneous rock on this lease is intrusive into altered impure limestones. An aureole of sericite and chlorite schists surrounds the intrusion. A prominent fracture pattern is in evidence, the principal direction being north to N. 20 deg. E. and the dip is vertical to steeply west. Sporadic copper mineralization occurs in a belt extending from the *Doris Norelle* to the *Federal* copper deposit. In three potholes, small amounts of torbernite and malachite have been exposed on joint faces, and sparse, sporadic grains of absite are also present in the granitic host rocks.

On the adjacent *Doris Allen* lease weak radioactivity occurs in a weathered granitic rock.

Gumbardo

Location : 24 miles west of Cloncurry and ¼ mile west of the *Wonder Valley* copper mine. It is in the *Three Brunettes* sub-group.

Calc-silicate rocks and numerous small dykes of pegmatite and graphic granite crop out in this area. A few grains of a brown, refractory, uranium mineral occur in the pegmatite. This mineral is probably absite.

On the adjacent *Why Not* lease, absite, and a creamy-yellow, earthy, weathering product occur in a quartz-felspar-hematite pegmatite at the edge of a small intrusion of graphic granite. However, no significant amount of uranium is present.

Hannan's Ridge

This is another davidite type occurrence in the *Three Brunettes* sub-group 25 miles west of Cloncurry. Coarse grains of davidite are sparsely and irregularly disseminated in calc-silicate rocks and hybrid granitic roaks. Similar mineralization occurs on the adjacent *Leydin's Ridge* lease.

Hidden Valley

The location of this lease is 6½ miles north-east of the *Mary Kathleen* and 1½ miles from the northern tip of the Mount Burstall granite. Radioactivity is associated with allanite in a pegmatitic zone within calc-silicate rocks. The deposit is of insignificant size.

Hobby Nos. 1–2

Location : 26 miles west-north-west of Cloncurry on the west side of the Cameron River. It is one to two miles north of the river crossing on the abandoned Cloncurry–Mount Isa road.

A davidite-type mineral occurs as floaters in soil and also in association with a calcite-actinolite-albite rock. Some uranium is also associated with a 1 foot wide quartz vein exposed in one of the costeans. A radioactive anomaly is exposed in two costeans 23 feet apart over a width of 1 foot to 3 feet.

On the adjacent *Verpat* lease a few floaters of a davitite-type mineral occur in the soil but the mineral has not been found *in situ.*

Huxy Nos. 1–3

Location : 13 miles north-north-east of the *Mary Kathleen* and adjacent to the abandoned Cloncurry–Mount Isa road.

The Corella Formation in the area is represented by calcite–actinolite–felspar–hornblende–quartz rocks with lenses of coarsely-crystalline calcite and calcite-actinolite rock. Dykes and bosses of granite and granite derivatives are of common occurrence.

On the *Huxy* the main radioactive anomaly is 3 to 4 feet in diameter and a considerable amount of a fluorescent, yellow, uranium mineral is distributed over this area. This is believed to be beta-uranotil (Dallwitz and Roberts, 1955, unpubd.). No primary uranium mineral is in evidence. At least two other very small areas of intense radioactivity occur on the lease.

The *Huxy No.* 2 lease adjoins the *Huxy* on the north. There is a radioactive anomaly 20 feet long by several feet wide and a yellow uranium mineral similar to that on the *Huxy* is present.

The *Huxy No.* 3 adjoins the *Huxy* on the south. Small areas of radioactivity occur in pegmatite and the adjacent calc-silicate rocks. A davidite-type mineral weathering to yellow and orange-coloured secondary minerals is sparsely distributed in these areas.

Janet Maude

Location: 11 miles north-north-east of *Mary Kathleen* and 2½ miles south-west of the Cameron River bore near the abandoned Cloncurry–Mount Isa road.

A davidite-type mineral and hematite occur as sparsely-distributed blebs in a medium to coarse-grained felspar-actinolite-calcite rock. Four costeans have been excavated. In one of these intense radioactivity occurs over a width of 2½ feet and weak radioactivity extends over an additional width of 6 feet.

The *Mount Harold* and *Janet Maude West* are adjacent leases but no significant radioactivity has been located on them.

Rosie B.

The location of this lease is ½ mile north of the *Huxy* and 13½ miles north-north-east of the *Mary Kathleen*. A davidite-type mineral has been found as floaters in the soil. Analyses by Lawrence *et al.* (1957) showed the radioactive specimens to be a mixture of davidite, ilmenite and hematite in the ratio of 50 : 40 : 10. A davidite specimen was analysed and found to contain 20·16 per cent. U_3O_8.

Six Kangaroos

Location: 14 miles north-north-east of the *Mary Kathleen* and a short distance west of the abandoned Cloncurry–Mount Isa road.

Davidite, magnetite and hematite occur as medium to coarse-grained blebs and crystals in a lens of crystalline calcite. The calcite lens is within calcite-actinolite-scapolite calc-silicate rocks, and pegmatite and aplitic granite crop out within a few hundred feet of the deposit. The davidite is irregularly and sparsely distributed through the calcite and most of the surface radioactivity results from detrital davidite in the soil around the calcite lens. Moderate to intense radioactivity occurs in two trenches 20 feet and 24 feet long and 8 feet apart. Apart from this the only radioactivity *in situ* was found in two other small outcrops. There is a small amount of davidite in a magnetite-bearing, oligoclase pegmatite within an area of granite on the *Six Kangaroos No.* 3 lease to the west of the main occurrence. One specimen of davidite from the *Six Kangaroos* assayed 3·5 per cent. U_3O_8 (Lawrence, 1954) and another assayed 2·6 per cent. U_3O_8 (Whittle, Sth. Aust. Dep. Min.).

Three Brunettes

This lease is 25 miles west of Cloncurry. Blebs of a davidite-type mineral are irregularly disseminated through a belt of felspar-actinolite calc-silicate rocks. The grade over a length of 140 feet and a width of 55 feet is 0·013 per cent. eU_3O_8. The deposit was systematically costeaned and sampled by Mount Isa Mines Ltd.

Three Inkspots

Location: 25 miles west-north-west of Cloncurry and approximately 2 miles north of the abandoned Cloncurry–Mount Isa road.

Quartz-epidote-hornblende rocks of the Corella Formation are intruded by pegmatite and graphic granite. Ten shallow pits have been excavated to to investigate isolated areas of radioactivity which occur in and along the edges of a pegmatite dyke over a distance of 200 feet. Intense radioactivity occurs in only three of these pits and in these there is a small amount of a yellow, earthy uranium mineral weathering from (?) absite. The mineral is brownish in colour with a vitreous lustre. It is a thorium-uranium titanate with a high thorium-uranium ratio. Magnetite is also associated with the pegmatite.

CLONCURRY GROUP

Coloured Rocks

This lease is 22 miles north of Cloncurry and 5½ miles north-north-west of Fort Constantine homestead. Weak radioactivity is associated with coarse-grained granite in an area which is largely covered by alluvium. Hematite is an accessory mineral in the granite but no uranium mineral has been observed.

Embla Ridge Nos. 1–5

Location: 14 miles south-south-west of Cloncurry and 2 miles north-east of the Cloncurry–Malbon road at the Slaty Creek crossing.

The uranium deposits on these leases are in meta-sediments of the Marimo Formation. They have been traced discontinuously over a length of nearly two miles in a north-south direction. Extensive faulting has affected the area and drag-folding is of common occurrence. In outcrop the uranium occurs either in metamorphosed, ferruginous sandstone or in massive, siliceous ironstone which has resulted from supergene alteration of ferruginous sandstone. Sericitic sandstone, clay slate and carbonaceous slate are interbedded. The ferruginous meta-sandstone is more resistant to weathering and forms prominent outcrops.

The largest and most highly radioactive deposit is on the *Embla Ridge No.* 3. This deposit is 630 feet long and 6 feet wide. Samples taken over widths of

4½ feet and 13 feet assayed 0·01 per cent. and 0·03 per cent. U_3O_8 respectively. United Uranium N.L. drilled two holes to test this deposit. Intersections of very weakly radioactive material were obtained at a depth of approximately 200 feet. This may indicate that the uranium mineralization at the surface has been formed by supergene concentration from a very low grade primary source. At least three less significant radioactive deposits occur to the south of the main deposit. The largest of these is 500 feet long by 2 to 3 feet wide. Two other deposits occur to the north and the larger of these is 120 feet long and 4 feet wide.

Helafells

Location: 22 miles south-south-west of Cloncurry and 9 miles south-east of the Cloncurry–Malbon road at the Slaty Creek crossing.

The deposits occur in quartzite and slates of the Marimo Formation which strike north to north-north-westerly and dip east at angles greater than 60 deg. The radioactivity occurs in discontinuous, massive deposits of ironstone over a length of ½ a mile. Stains of malachite occur in the radioactive outcrops and flakes of torbernite can be seen at points of higher radioactivity. There are several small, lenticular deposits, the largest being 50 feet long and 5½ feet wide. A second deposit is 45 feet long and 4½ feet wide. Mining Corporation N.L. carried out wagon-drilling and sank a shaft to a depth of 240 feet on the largest deposit. A true width of 30 feet of weakly radioactive material was obtained in a crosscut at this depth. A few flakes of torbernite were observed in the crosscut, indicating that the primary zone had not been reached. Small, weakly-radioactive deposits occur on the *Helafells North* and *South* leases on the same line of strike as the *Helafells* deposits.

Hot Rocks

Location: 3 miles east-south-east of Cloncurry and ¼ mile south of the Cloncurry–Julia Creek road.

The radioactivity occurs in ironstone and hematite quartzite beds within a succession of amphibolite, mica schist and quartzite in the Soldier's Cap Formation. The strike is N. 75 deg. W. and the dip is 75 deg. to 85 deg. north. Stains of malachite are associated with the radioactive deposit which is similar in type to that at the *Tinboll*. The total length of the radioactivity is 570 feet and the width is 6 feet. The intensity of radioactivity decreases along the strike with the decrease in the iron content of the bed. Surface samples indicate that the area of highest radioactivity would only average 0·04 per cent. U_3O_8.

Milo

Location: 20 miles west-south-west of Cloncurry and 13 miles east-south-east of the *Mary Kathleen*. The Cloncurry–Mary Kathleen bitumen road passes ¼ mile to the south of the deposit.

The *Milo* occurs in the Corella Formation near the closure of a north-pitching regional anticline. The strike is east to east-south-east and the dip is to the north at 75 deg. Carbonaceous and siliceous slates and calc-silicate rocks crop out on the lease. These have been highly deformed by faulting and folding and the resulting structural pattern is complex.

A siliceous ironstone and jasper gossan is exposed discontinuously along a prominent ridge over a distance of nearly one mile. It parallels the strike of the bedding. Very weak radioactivity is associated with much of this gossanous material, particularly towards the eastern end of the ridge. Scattered flakes of torbernite have been observed in the gossan at several points. The main surface radioactivity is confined to a lens of torbernite-bearing kaolinitic clay. The higher grade section of this radioactive anomaly is 110 feet long by 10 feet wide and has a grade of 0·135 per cent. U_3O_8. It was tested by Mount Isa Mines Ltd. by costeaning and shaft sinking to a maximum depth of 35 feet (see Fig. 15). It appears to be a supergene concentration associated with a cross-fault feature. The cross-fault strikes northerly and dips easterly at 65 deg. Torbernite occurs as disseminated fine to medium flakes and as coarse flakes on joint and fracture planes. A parcel of 9·3 tons of hand picked torbernite ore sent to Rum Jungle for treatment assayed 0·76 per cent. U_3O_8.

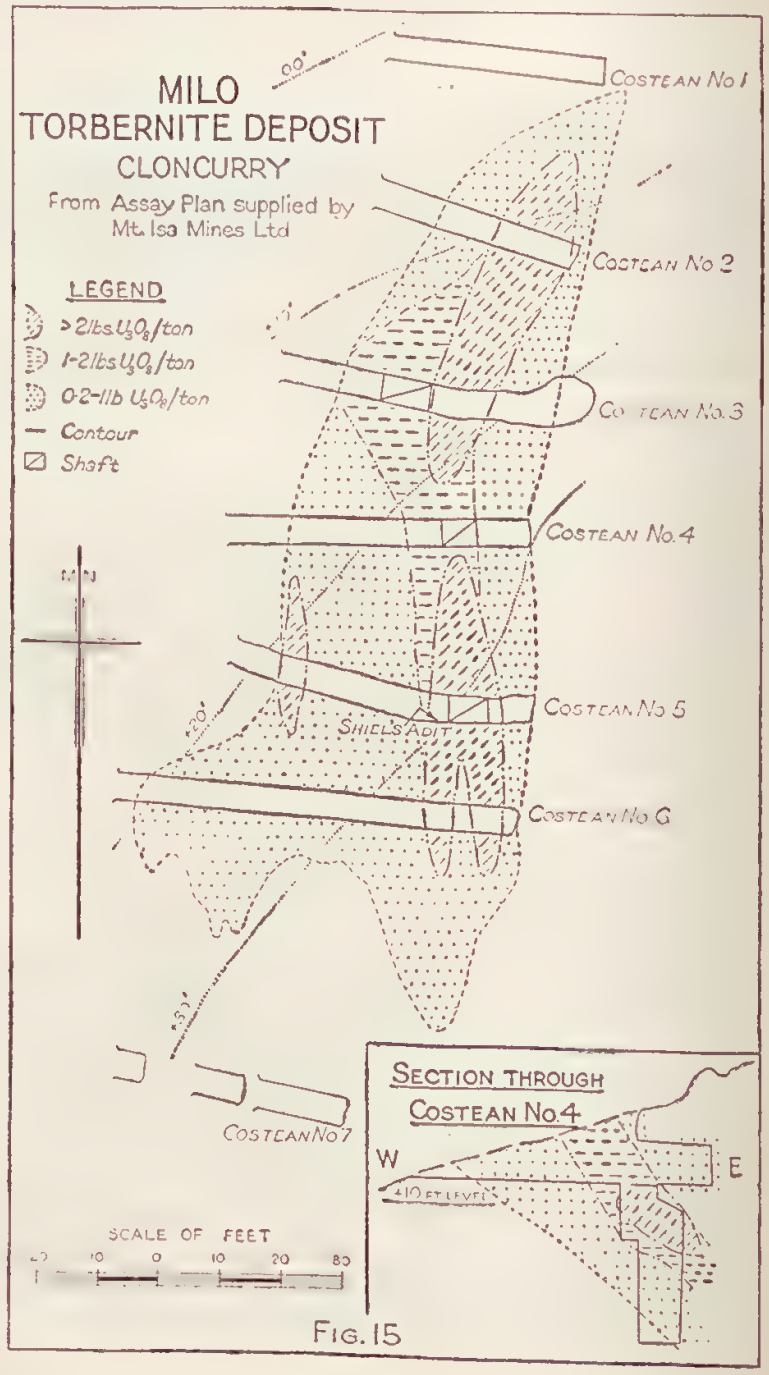
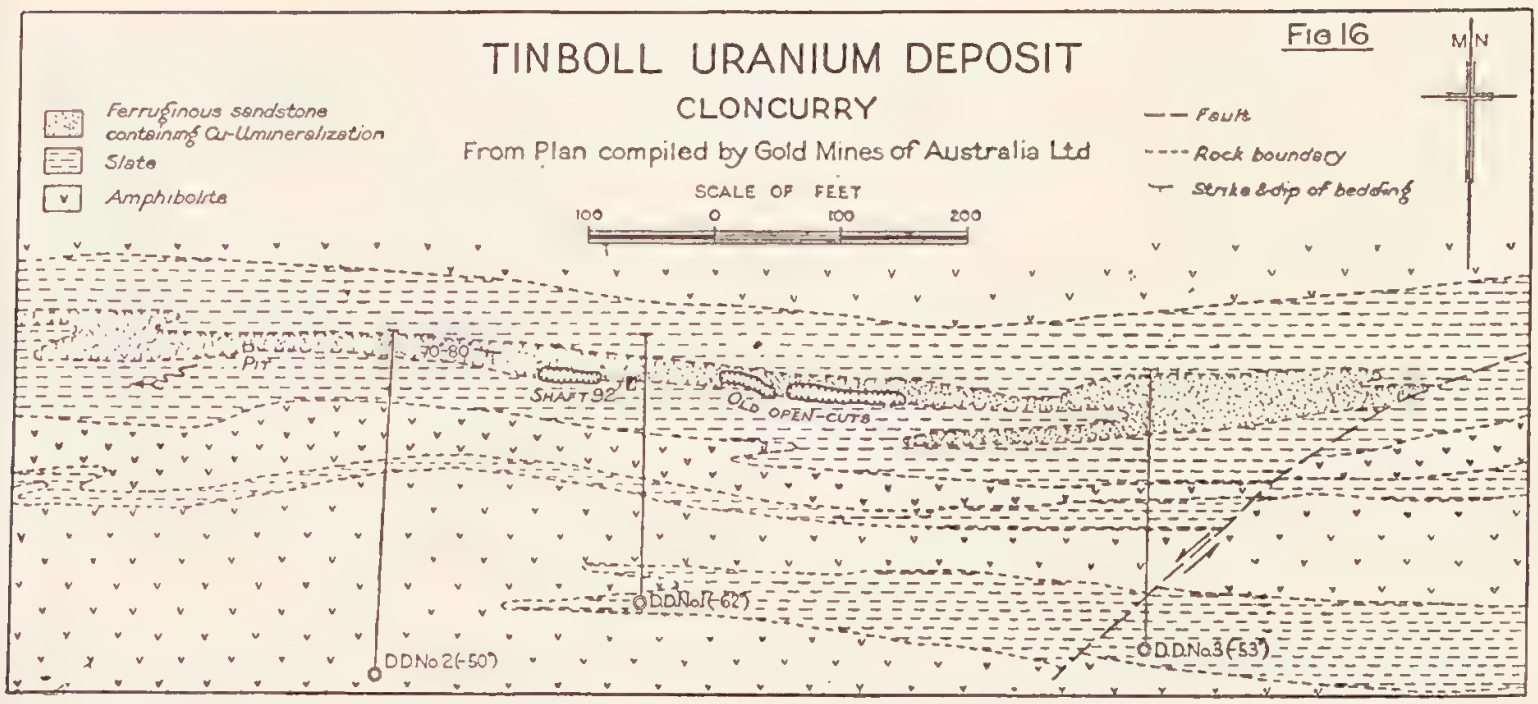


FIG. 15



Shaft sinking and diamond drilling was carried out by Paringa Wheal Fortune Pty. Ltd. A prospecting shaft was abandoned at 120 feet in semi-oxidised gossanous material and none of the four diamond drill holes obtained intersections of primary uranium ore. The drilling has shown that the ferruginous gossan is the surface expression of a sulphide lode consisting very largely of pyrite with subordinate amounts of copper, lead and zinc sulphides. Fluorite is abundant in the gangue. The primary zone to the east of the torbernite-kaolinite lode has not yet been adequately tested and it is considered that this section holds the best prospect for the discovery of significant mineralization.

Olive

Location : 15 miles south of Cloncurry and 1½ miles east of the Cloncurry River.

The Marimo Formation in this area is represented by slates and quartzites which strike N. 30 deg. E. and dip steeply to the east. Radioactivity is confined to a ferruginous replacement deposit in slates. Residual manganese oxides are present in sections of the deposit and extensive copper-staining occurs in the adjacent carbonaceous slates. Very weak radioactivity extends discontinuously over a length of ½ a mile. The main area is 300 feet long and 10 feet wide. No assay data are available but from the intensity of radioactivity the grade is expected to be very low. The deposit is comparable with the *Embla Ridge* deposits described above.

Sierra Rada

Location : 2 miles north-north-west of the *Helafells* and 20 miles south-south-west of Cloncurry.

The geology is similar to that of the *Helafells* but the bedding here dips 70 deg. to the west. Uranium and the associated copper mineralization occur in a sandstone horizon. Torbernite is present mainly on joint planes. A radioactive anomaly on the lease is 75 feet long and 22 feet wide. No assay data from representative samples are available and the deposit has not been tested at depth. Some collapsed workings indicate that the deposit was previously tested for copper.

Tinboll Nos. 1–7

Location : 13 miles north-east of Cloncurry and 4 miles west of Mapperley Park homestead.

Radioactivity occurs in a horizon of sandstone which strikes N. 75 deg. E. and dips 70 deg.–80 deg. south. It is interbedded with amphibolite, mica schist and slate of the Soldier's Cap Formation. Strike faulting has taken place along the sandstone horizon and the beds are drag-folded. The *Tinboll Nos.* 1–5 leases surround the *Monakoff* freehold which was worked for copper in the early mining days (see Fig. 16). Some torbernite and a small quantity of a yellow-green, fluorescent uranium mineral are present in the outcrop. Other minerals present in approximate order of abundance are hematite, limonite, fluorite, malachite, psilomelane, barytes, chrysocolla, quartz, azurite, and garnet. Shaft sinking and diamond drilling were carried out by Gold Mines of Australia Ltd. This showed that the mineralization in the primary zone consists of disseminated magnetite, pyrite and chalcopyrite with fluorite, quartz and calcite. Minute inclusions, which may be uraninite, occur in the fluorite. Diamond drilling tested the deposit to a depth of 250 feet and showed no increase in the grade of the primary ore over that of the oxidised ore at the surface. The main radioactive anomaly is 360 feet long and 14 feet wide. The grade indicated by the three diamond drill holes is 0·02 per cent. U_3O_8 and 1·6 per cent. Cu. Assays of up to 0·45 per cent. U_3O_8 were obtained from the prospecting shaft which was sunk to a depth of 93 feet in the highest grade section of the lode. However, no appreciable quantity of such material was indicated by the exploratory workings. Other anomalies to the west showed weaker radioactivity over areas of 85 feet by 8 feet and 70 feet by 7 feet.

A radioactive anomaly on the *Tinboll No.* 6 and 7 is 1½ miles east of the main deposit and may be on the same horizon in the Soldier's Cap Formation. The anomaly is 200 feet long and 10 feet wide and the grade indicated by one diamond drill hole intersection is 0·04 per cent. U_3O_8. Weak copper mineralization is again associated with the uranium in the ferruginous lode but the grade is too low to be of any significance.

TABLE 6.—DIAMOND DRILLING DATA: TINBOLL (supplied by Gold Mines of Australia Ltd.)

D.D. No.	Position	Direction	Declination	Intersection	Width	% U_3O_8	% Cu
				Feet	Feet		
1	Opposite the prospecting shaft in the main anomaly	North	62°	237–241	4	0·05	3·0
				241–253½	12½	0·01	0·14
				253½–297½	44	0·013	2·1
				297½–310½	13	0·10	3·0
2	200 feet west of No. 1 hole	North	50°	313–318½	5½	0·02	2·03
				318½–324	5½	0·015	1·37
				324–329	5	0·01	0·42
3	400 feet east of No. 1 hole	North	53°	250½–252	1½	0·01	1·8
				260–263	3	0·015	1·6
				267½–272½	5	0·015	0·73
				272–291½	19½	0·02	1·70
4	1½ miles east of main anomaly	South	50°	170–183	13	0·037	..

BALLARA GROUP

Ballara Nos. 1–2

This is a davidite type deposit which is situated just north of the deserted township of Ballara, 11 miles south-south-west of Mary Kathleen. Pegmatite dykes, granitic rocks and calc-silicate rocks crop out in the area. A davidite-type mineral and hematite occur as irregularly disseminated, coarse aggregates in a coarsely—crystalline, massive, felspar-amphibole rock. Quartz—felspar—muscovite pegmatite crops out in close proximity to the occurrences, none of which are of more than a few square feet in area.

A similar occurrence of a davidite type mineral in granulite is located 3 miles south-west of the old *Wee McGregor* copper mine.

Lady Rachel

Location: To the south-east of the Mount Philp ironstone ridge, 4 to 5 miles south of Ballara. Sixteen miles south-south-west of Mary Kathleen.

Radioactivity occurs at isolated points in granite over a length of one mile and within a zone 50 feet wide. The granite is basified in part due to contamination by the calc-silicate rocks it intrudes. Graphic granite and pegmatite are also associated with the radioactivity in part. At the points of intense radioactivity a greenish-yellow mineral is present which has been identified as absite. The U : Th. ratio in assays of samples of this material is 1 : 3.

Pelican

Location: 6 miles south-south-east of Ballara and 19 miles southerly from Mary Kathleen.

The Corella Formation is represented in this area by slates and calc-silicate rocks. The main structural feature is a regional quartz-filled fault which strikes N. 20 deg. E. and dips steeply to the west. The beds within 100 feet of the fault have been crumpled and drag-folded. It is in these deformed beds to the west of the fault that the uranium mineralization is localized. Copper-staining is also widespread but is not closely associated with the uranium. Surface radioactivity is weak but costeans have exposed more highly radioactive material. In two costeans narrow veins of uranophane, over a maximum total width of 3 feet, have been exposed. Systematic costeaning was carried out by United Uranium N.L. Two ill-defined radioactive anomalies occur over a length of several hundred feet parallel to the fault but no assay data are available. The leached nature of this deposit at the surface gives some encouragement for underground exploration.

A davidite type deposit 1 mile south-west of the *Pelican* is associated with pegmatite dykes which intrude banded calc-silicate granulites. Radioactivity extends over a length of about 900 feet. A similar small occurrence is located 1½ miles south-south-west of the *Pelican*.

Prize

Location: 9 miles north of Duchess and 4 miles east-south-east of the *Mount Hope* copper mines.

The country rocks are quartz-hornblende schist and calc-silicate rocks which strike north and dip west at 50 deg. Uranium mineralization is confined to a quartz lode in a shear zone which strikes N. 15 deg. E. and dips vertically. At the points of high radioactivity the quartz and decomposed felspar lode material contain a lemon-coloured uranium mineral. This occurs either in a powdery or soft, waxy form. The uraniferous lode is 43 feet long by 8 feet wide and a representative sample assayed 0·07 per cent. U_3O_8 (chemical).

Occurrences of a davidite-type mineral are situated near the *Prize*, 8 and 10½ miles north-north-east of Duchess. The davidite-type mineral is associated with pegmatite dykes which intrude calc-silicate granulites and metamorphosed impure limestones.

The Springs

Location: 4½ miles south-south-west of Ballara and 16 miles from Mary Kathleen in the same direction.

Radioactivity is associated with a quartz-filled fault near the eastern margin of a large area of granite and granitized metasediments of the Corella Formation. The siliceous lode strikes N. 25 deg. E. to N. 45 deg. E. and the dip is 50 deg. to 70 deg. west. Weak radioactivity is associated with bands of jasper towards the footwall of the lode. The jasper bands have an average total width of 6 feet and usually two bands are present. The surrounding granite gives readings of over twice

background radioactivity. Copper-staining is associated with the fault and an old prospecting shaft is situated a short distance north of the uranium deposit. Significant radioactivity is confined to small concentrations of secondary minerals which consist of torbernite and an unidentified, yellow, ochreous mineral. These occur with quartz, kaolin, and jasper and are best exposed in a trench at the southern end of the jasper lode. Although these supergene concentrations are of little economic significance, the association of uranium mineralization with a prominent fault structure makes the deposit worthy of a close study and possibly some underground exploration.

KURIDALA–MOUNT COBALT GROUP

Fluke

This lease is four miles east of Kuridala. Torbernite occurs in small, sporadic patches in an altered granitic rock. The country rocks are amphibolite, quartzite and mica schist of the Kuridala Formation.

Glen Idol

Uranium mineralization occurs in the Corella Formation adjacent to a branch of the Cloncurry overthrust fault, 4 miles west-south-west of Glen Idol homestead and 16 miles east of Kuridala. A yellow, secondary uranium mineral occurs in the deposit which is very restricted in extent.

Kathleen

The *Kathleen* is situated three miles south-south-west of Kuridala. Copper and uranium mineralization occur in a ferruginous lode in the Kuridala Formation. The lode consists of quartzitic material and ferruginous gossan carrying magnetite, oxides of manganese, pyrite, and chrysocolla. A green, micaceous, fluorescent uranium mineral is sparsely disseminated in flaky aggregates. It is propably autunite. Uranium also appears to be associated with the magnetite. Radioactivity extends over a surface area of 600 feet by 20 feet but the grade is low.

Mariposa

Location : 13 miles south of Selwyn and 2 miles south of the Selwyn–Toolebuc track.

The Kuridala Formation is represented in the vicinity of the lease by slates and quartzites. There are two radioactive anomalies $\frac{3}{4}$ mile apart on the lease. Mineralization in the southern anomaly has been exposed in a small open-cut. Intense radioactivity is confined to a width of 8 feet along a sheared contact between slate and fine-grained quartzite. The strike of the bedding is N. 30 deg. W. and the dip is 60 deg. east. Torbernite and (?)saleeite occur in the shear zone and copper carbonates are also present. Slates adjacent to the shear have been kaolinized and somewhat contorted. Surface radioactivity is very weak and trenching along the slate-quartzite contact would be necessary to indicate the extent of significant mineralization. A shaft was sunk to test copper mineralization a little to the south of the open-cut and on approximately the same line of strike.

The northern radioactive anomaly is in a massive, limonite-quartz-jasper gossan. Fairly uniform, weak radioactivity extends over a length of 130 feet and a maximum width of 15 feet. Some radioactivity of higher intensity on the footwall or western side of the anomaly is associated with copper-staining. The strike is N. 30 deg. E. and the dip is steeply to the south-east. Supergene concentration of uranium in association with the iron oxide minerals may have taken place.

Mount Cobalt

Location : 15 miles south of Selwyn and 4 miles south of the Selwyn–Toolebuc road.

Minor uranium and tungsten mineralization is associated with copper and cobalt in the *Mount Cobalt* mine which produced 766 tons of cobalt. Mineralization occurs in a shear zone along and adjacent to the contact of an amphibolite sill with mica schist and quartzite. Torbernite was found in the vicinity of the No. 1 Adit near the southern end of the mine workings.

A diamond drill hole was put down by Mount Isa Mines Ltd. to intersect the lode 200 feet south of the Main Shaft. A lode intersection was obtained from 280–300 feet but no significant amounts of cobalt, copper or uranium were obtained.

Mount Dore

Location : 10 miles south of Selwyn and just north of the Selwyn–Toolebuc road.

The Kuridala Formation is represented here by slates which are intruded by granite to the east of Mount Dore. A prominent, north-south striking, quartz-filled fault occurs to the west of the deposit. Stainings and impregnations of copper carbonates occur over an extensive area in the slates and several shafts and pits were sunk in the early mining days to test the copper values. Visible uranium mineralization is confined to an area a few feet square where sparsely-disseminated flakes of torbernite are present. A diamond drill hole was put down to test the copper deposit but no uranium was found in association with the copper at depth.

Painted Hills

This lease and the neighbouring *Taipan* lease are situated 9 miles north of Kuridala. A small quantity of torbernite occurs in quartzite and siliceous calc-silicate rocks of the Corella Formation.

Percol Creek

The location is 21 miles west of Percol Plains homestead which is 19 miles north-west of McKinlay. A small area of granite exhibits radioactivity appreciably above background. The granite is coarse-grained and is iron-stained on joint planes. A sample taken from a pothole excavated at the point of highest radioactivity assayed 0·04 per cent. eU_3O_8.

Robert Heg

This is a davidite type occurrence situated $5\frac{1}{2}$ miles north-east of Kuridala. The Corella Formation is represented in the area by calc-silicate rocks composed of actinolite, felspar, pyroxene and garnet. The Williams granite crops out a short distance to the west

and a pegmatite dyke swarm occurs in the adjacent meta-sediments. Near the granite and in the immediate vicinity of the pegmatites the meta-sediments have been metamorphosed to hornblende and mica-schists. The strike of the bedding is N. 5 deg. W. and the dip is steeply west to vertical. Small patches of radioactivity (no more than a few square feet in area) occur in pegmatite and in the adjacent meta-sediments in a zone half a mile long and situated 20 to 40 chains north and north-west of the margin of the major granite intrusion. A davidite-type mineral was located in several of these areas of radioactivity.

Other occurrences of a davidite-type mineral are situated in the upper *Farley Creek* area, 7 to 9 miles south-east of Kuridala. They are confined to granite areas. Another davidite occurrence, 11 miles west of Kuridala is in a calc-silicate rock near granite.

Utah

Location : 8 miles west-south-west of Selwyn and ½ mile south-east of the *Belgium* copper mine.

The area in the vicinity of the deposit is largely soil-covered but there are rubbly outcrops of a medium to coarse-grained granite which represents marginal material of the Gin Creek granite. The granite is poor in ferromagnesian mineral but some tourmaline was observed. Intense radioactivity occurs in boulders of a granular hematite-quartz gossan. In cavities in the gossan a pale yellowish-green, micaceous mineral (?autunite) is visible and some torbernite is also present. No definite lode has been indicated by the six shallow trenches excavated on the deposit. At the abandoned *Belgium* copper mine the quartz-hematite-copper carbonates lode material exhibits weak radioactivity and the surrounding granite is also slightly radioactive. The *Utah* deposit may represent a supergene concentration of uranium mineralization but the area surrounding the Gin Creek granite warrants a close examination since there is a possibility that significant uranium mineralization may have been associated with the intrusion of this granite.

MOUNT BIRNIE GROUP

First Try Nos. 1 and 2

Location : 20 miles south-south-east of Duchess and 1·3 miles south of Mount Birnie.

A ferruginous laterite occurs as a capping over beds of the Lower Cambrian Birnie Arkose. The beds strike northerly and dip east at 5 deg.–12 deg. Weak radioactivity is present in this cap rock over a north-south distance of 2 miles. It has a width of 20 to 40 feet. The intensity of radioactivity increases with the iron content of the rock and the occurrence appears to represent a superficial concentration. Specimens from a shallow pit assayed 0·045 per cent. eU_3O_8. Sparsely disseminated flakes of torbernite have been observed.

Similar deposits occur on the neighbouring *Mother's Hope Nos.* 1–2 leases and the *Mary Lou* lease which is situated 3 miles south of the *First Try* leases. Selected samples from the *Mary Lou* lease assayed as much as 0·36 per cent. and 0·40 per cent. eU_3O_8 but the average grade would be less than 0·05 per cent. U_3O_8.

WESTMORELAND GROUP

The deposits in this group have been described by Syvret (1957) and Batty (1957) in unpublished reports to Mount Isa Mines Ltd. and by Brooks (1958).

Buck Hill

This occurrence is 9 miles south of Westmoreland homestead and 12 miles east-north-east of the *Redtree* prospect. Very weak radioactivity occurs in coarse sandstone over an area of 400 square yards. A yellow, unidentified uranium mineral has been observed.

Contact

The location of this occurrence is 14 miles south of Westmoreland homestead and 12 miles east of the *Redtree* prospect. Appreciable radioactivity is confined to a small area of lithic sandstone. Torbernite is visible in two places.

Long Pocket

Location : 10½ miles south-south-west of Westmoreland and 8 miles east-north-east of the *Redtree* prospect.

Two radioactive anomalies occur in which yellow and green uranium minerals have been observed. The larger anomaly is in fine-grained, felspathic sandstone and appreciable radioactivity extends over an area of about 250 square yards. The overall intensity of radioactivity is much lower than at the *Redtree* prospect.

Redtree

Location : 16 miles south-west of Westmoreland homestead and 6½ miles east of the Northern Territory border.

The Westmoreland Conglomerate in which the deposit occurs has an east-north-east strike and dips northerly at 5 deg. Cross-bedding and lensing of beds is of general occurrence and correlation of horizons is only possible over short distances. There are two prominent sets of vertical joints which strike N. 55 deg. E. and N. 55 deg. W. Several areas of radioactivity are adjacent to joints of these types. The host rock is a coarse-grained, felspathic sandstone. The felspar has been extensively kaolinized. Iron and manganese oxides are commonly present in the host rock and may have acted as precipitation agents for the uranium-bearing

Rugged outcrop of Westmoreland Conglomerate containing secondary uranium mineralization.

[Photo by K. Wolff.

solutions. At least 12 horizons in the formation have been mineralized in part (Syvret, 1957 unpub.). Uranium is also localized in earthy bands between beds of sandstone. Yellow and green uranium minerals occur as disseminated grains. Carnotite, meta-torbernite, zeunerite and uranospinite have been identified by the South Australian Department of Mines and renardite, soddyite and phosphuranylite were identified, in addition to carnotite and meta-torbernite, by the Commonwealth Bureau of Mineral Resources.

The deposits were mapped and sampled by Mount Isa Mines Ltd. Nine prospecting pits and 11 wagon drill holes were sunk to explore the deposits to a shallow depth.

TABLE 7.—SUMMARY OF DATA FROM TEST PITS: REDTREE (supplied by Mount Isa Mines Ltd.)

Grid Area No.	Area	Pit No.	Depth	% U_3O_8	Remarks
1	1,208′ x 50′	1	10′	0·58	Sunk in an area of high radioactivity. Grade decreases with depth ..
		2	11′	0·042	180′ south of Pit No. 1 ..
		3	10′	0·051	175′ east of Pit No. 1 ..
					Mineralization disseminated in 3 horizons of sandstone and in narrow earthy bands
5 Dinner Camp	420′ x 50′	4	11′	0·012	1,130′ north of Pit No. 1
		5	11′	0·009	1,340′ north of Pit No. 1
					Mineralization disseminated in 3 horizons of sandstone. Vertical joints associated
6	4,109′ x 50′	6	4′	0·07	1,840′ north of Pit No. 1
		7	4′	0·012	1,580′ north of Pit No. 1
		8	4′	0·004	1,460′ north of Pit No. 1
		9	4′	0·007	1,520′ north of Pit No. 1
					5 mineralized horizons in sandstone

ISOLATED OCCURRENCES

Black Valley

Locality: 2 miles west-south-west of the abandoned Glenroy homestead on the Leichhardt River and 28 miles north-east of Mount Isa. The *Black Reef*, *Kironga* and *Fisher's Gift* leases are adjacent to the *Black Valley*.

Weak radioactivity is associated with siliceous limonite lodes. Surface concentrations of manganese oxides occur in sections of the lodes which strike northerly to north-easterly and dip vertically. The country rocks consist of quartzite, slate and impure limestone of the Surprise Creek Beds. No uranium mineral has been identified and the radioactivity is thought to result from a supergene concentration of uranium in association with iron oxides.

Dajarra

Floaters of davidite are reported to occur a few miles north-east of Dajarra which is the terminus of a branch railway line from Duchess (Lawrence *et al.*, 1957). Schists crop out nearby but no davidite was found *in situ*. The davidite is steel grey in colour and contains minute inclusions of ilmenite, hematite and quartz. It was found by chemical analysis to contain 6·41 per cent. U_3O_8. Ilmenite and ilmenite-hematite intergrowths occur in granite and contact metamorphic zones near the *Trekelano* copper mine north-east of Dajarra (Rayner and Nye, 1936 and Edwards, 1938). A davidite-type mineral is associated with ilmenite at a locality nearly 2 miles north-north-east of the *Trekelano* mine.

Mount Carolian and Mount Lawler

The *Mount Carolian* and *Mount Lawler* leases are situated 4 miles west, and 9 miles north-north-east of Kajabbi, respectively. The presence of uranium has been confirmed in samples from the radioactive anomalies but the intensity of radioactivity is very weak.

Quamby

Davidite is reported to occur as rounded crystalline floaters 1 mile north-north-west of Quamby which is 28 miles north-west of Cloncurry. The floaters are thought to be derived from the adjacent schists although no davidite was seen *in situ* (Lawrence *et al.*, 1957). Tourmaline pegmatites intrude the schists. A similar occurrence of a davidite-type mineral is located 2 miles north-north-west of Quamby.

Kajabbi

Nine miles east-south-east of Kajabbi and approximately 2 miles east of the *Queen Sally* mine there is a small occurrence of a davidite-type mineral. The mineral is sparsely disseminated through granulite which is untruded by pegmatite.

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(A. K. Denmead, M.Sc., Chief Government Geologist)

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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 14 P.D.T.S. Nos. 11, 12 AND 14 MINE AREAS, RHONDDA

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SUMMARY

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As part of the diamond drilling programme recommended by Messrs. Powell Duffryn Technical Services Ltd. to establish reserves in the Ipswich Coalfield, the Rhondda mine area was tested by thirteen boreholes.

This report, accompanied by nine figures, describes in some detail the geology of the area with particular reference to the coal seams and provides an assessment of coal reserves available for development.

Variation in the section of the Striped Bacon Seam has been studied in detail and its components related to the sections worked in various parts of the colliery.

Measured reserves have been calculated for the Striped Bacon Seam only. These lie wholly to the dip of present workings and show a progressive southerly increase in ash content.

Although some boreholes indicate that workable coal remains in the Four Feet, Striped Bacon and Rob Roy Seams in the northern part of the area, for various reasons no tonnages can be estimated.

In an area of 190 acres, total measured reserves in the Striped Bacon Seam amount to 2·7 million tons with average ash 33·8 per cent. Washability tests indicate that with discard of 25·6 per cent., this would be reduced to 2 million tons carrying 20·0 per cent. ash. Additional reserves, for which there is no basis for estimate, lie to the north of the Rhondda fault.

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I. INTRODUCTION

Rhondda Colliery lies within the area comprising portions 250–252, 273–276, 281 and 283A, parish Goodna. No. 1 Shaft, the principal entry, is located almost centrally in portion 276. Access is by road two miles southerly from Dinmore and by rail three miles from Redbank along the Redbank–Bundamba loop line. Coal is being won from the Striped Bacon and Rob Roy Seams at the rate of approximately 530 tons a day.

Drilling was undertaken by the Mines Department to assess coal reserves in the seams underlying P.D.T.S. Nos. 11, 12 and 14 Mine Areas, especially the Striped Bacon and the Rob Roy. During the period of the campaign from 5th June, 1956, to 11th January, 1957, thirteen holes were drilled, numbered respectively N.S. 141 to N.S. 152 and N.S. 154. They ranged in depth from 140 ft. 3 in. (N.S. 142) to 979 ft. 6 in. (N.S. 146) and totalled 8,683 ft. 10 in. The Mines Department Joy Sullivan 37 and Failing 2500 drilling plants drilled eight and four holes respectively and a Mindrill A 3000 plant on loan drilled one hole.

Bore cores were logged by B. W. Hawkins and D. C. Mengel. Inspection and sampling of underground coal faces were carried out by the writer, who was assisted in the surface geological mapping by L. G. G. Pearce. Acknowledgement is also made of assistance rendered in underground inspections by Mr. W. Ritchie of Rhondda Colliery staff.

The outcrop of the Rob Roy Seam was used as an arbitrary boundary between the area considered in this report and the Cooneana Estate Mine Area to the west. Five boreholes, N.S. 163, 165–167 and 173, sited east of the Rob Roy outcrop were part of the Cooneana Estate drilling programme, which was directed towards proving the Cochrane Seam, 300 ft. below the Rob Roy Seam. These holes are dealt with in the report on that area (Mengel, 1960).

The present report is accompanied and illustrated by the following plans and sections:—

Figure 1. Plan showing topography, surface geology and boreholes. Locality Plan.

Figure 2. Plan showing mine workings, boreholes, P.D.T.S. Mine Areas and limits of estimated reserves.

Figure 3. Cross sections.

Figures 4a and 4b. Generalised borehole sections.

Figure 5. Detailed sections of Four Feet Seam.

Figures 6a and 6b. Detailed sections of Striped Bacon Seam.

Figure 7. Detailed sections of Rob Roy Seam.

Figure 8. Structure contour plan of Striped Bacon Seam.

Figure 9. Correlation diagram of Striped Bacon Seam.

II. GEOLOGICAL SUCCESSION

(a) Ipswich Coal Measures

(i) Cooneana Formation.—The Cooneana Formation (Allen and Staines, 1959), essentially a succession of massive medium-grained to coarse pebbly sandstones with thick interbedded lenses of shale, does not crop out in the Rhondda area, but is typically developed over a large area to the west in the adjoining Cooneana Estate. Its uppermost members were penetrated in ten holes of the Rhondda drilling programme which were drilled below the Rob Roy Seam. The Rob Roy Seam, whose pavement is the upper limit of the formation, is underlain by from 10 to 25 ft. of shale and siltstone, which is underlain in turn by massive sandstone characteristic of the formation.

(ii) Blackstone Formation.—Shales, sandy shales and lenticular sandstone lenses typical of the Blackstone Formation (Allen and Staines, 1959) crop out over half of the area. Definition of the upper limit of the formation is difficult because of poor development of the Aberdare Conglomerate in this part of the Ipswich Coalfield. The uppermost identifiable seam is the Bluff Seam, the Aberdare Seam having disappeared from the sequence towards the north of the Blackheath–Bonnie Dundee area which adjoins the Rhondda area on the south (Hawkins, 1958A). At outcrop, and where the Bluff Seam is present in the boreholes, a coarse or pebbly siliceous sandstone lies at a distance of up to 50 ft. above it. This sandstone is tentatively equated to the Aberdare Conglomerate and its base is therefore regarded as the upper limit of the Blackstone Formation.

The thickness of the formation attains a maximum of 500 ft. and averages 440 ft. It decreases eastward from the outcrop, as exemplified in the south of the area, where a 500 ft. thickness near N.S. 173 decreases to 370 ft. near N.S. 148 (Section C-C′, Figure 3). This is due to the combined effect of removal of the upper beds by pre-Aberdare Conglomerate erosion and progressive eastward thinning of the individual beds, especially the Blackheath Sandstone Member.

The Blackheath Sandstone Member (Staines, 1959), formerly known as the "Four Feet Sandstone", crops out prominently in portion 275 ahead of Jones No. 1 Tunnel and in portion 281 overlying the old Noblevale No. 1 workings on the Four Feet Seam. Its thickness in the Rhondda area ranges from 200 ft. to 70 ft. Intercalated lenses of shale and siltstone commonly split the sandstone sequence into two or three sections. B. W. Hawkins (1958A, p. 2), reaffirming the suggestion of A. K. Denmead (1955,

p. 14), held that this intercalation as exhibited in the Blackheath–Bonnie Dundee area invalidated the use of the term "Four Feet Sandstone" for any single bed of sandstone lying above the Four Feet Seam as was originally proposed by W. E. Cameron (1907). However the predominantly sandstone sequence between the Bluff and Four Feet Seams, from the top of the highest sandstone to the bottom of the lowest sandstone inclusive of the interbedded shales, is here regarded as the one stratigraphic unit, the Blackheath Sandstone Member. It lies immediately above the Four Feet Seam in boreholes N.S. 143, 145, 146, 147, 151 and 152, but is separated therefrom in other boreholes and at the surface by up to 100 ft. of shale and siltstone. This relationship is depicted in Figure 3. In N.S. 154 the member is not easily identifiable, as a large proportion of the strata above the Four Feet Seam is apparently shale. As this record is based mainly on cuttings from non-cored sections of the hole it possibly may not be wholly correct.

The Blackstone Formation here contains five named coal seams, viz., Bluff, Four Feet (including Top Coal), Bergin, Striped Bacon and Rob Roy. All except the Bluff have been worked in Rhondda Colliery.

Seam intervals vary: the Four Feet-Bergin interval is a notable example. In Noblevale No. 1 Colliery the Bergin Seam is reported to lie within 5 ft. of the floor of the Four Feet Seam. Near the entrance to Noblevale Bergin Tunnel the two seams form a continuous section. In N.S. 151, further east, 11 ft. of coaly shale which is probably equivalent to the Bergin Seam lies 20 ft. below the Four Feet Seam. Progressing northwards from Noblevale Bergin Tunnel the interval increases further and is exaggerated at outcrop by easterly sloping ground. In Rhondda No. 1 Shaft the seams are separated by 68 ft. of strata.

On the summit of Cooneana Ridge in portion 252 where the Four Feet Seam crops out as an elongate oval-shaped outlier it is continuous at the south-western end of the outcrop with the Bergin Seam. In a section exposed by the collapse of old Bergin Seam workings just east of the summit of the ridge the Four Feet and Bergin Seams are separated by three to four feet of shale. In collapsed ground five chains north-east some 15 to 20 ft. of strata occupy this interval, the shale having developed in part into a fine sandstone. Because of further remarkably rapid lateral growth this bed is continuous with a massive medium-grained sandstone at least 35 ft. thick which crops out boldly five chains further north-east. The sandstone occupies a dip slope extending for about 24 chains south-south-east and, as exposed in section in collapsed ground, usually lies immediately above the Bergin Seam.

(b) Bundamba Group

(i) Aberdare Conglomerate.—No typical section of the Aberdare Conglomerate is known in the area. On the surface and in boreholes N.S. 141, 145 and 151 the Bluff Seam is overlain either immediately or at a distance of up to 40 ft. by beds of medium- and coarse-grained sandstone which in a few places is pebbly towards the base. This sandstone is assumed to be the equivalent horizon of the Aberdare Conglomerate. In boreholes N.S. 143, 146, 147 and 148 the Bluff Seam is absent from the sequence. The coarse or pebbly sandstone which succeeds the shales overlying the Blackheath Sandstone Member is therefore equated with the Aberdare Conglomerate.

A bed of light pinkish-grey shale carrying numerous needle-shaped grains of iron carbonate occurs below the Aberdare Conglomerate in boreholes N.S. 146, 147 and 151. Working in the Blackheath–Bonnie Dundee area immediately to the south, Hawkins (1958A) used this bed as a marker "at about the horizon of the Aberdare Seam." In the Rhondda area, however, the Aberdare Seam does not exist, and this characteristic shale is associated with the Aberdare Conglomerate equivalent. In N.S. 151 the "pink shale" (as it is commonly termed) lies just above the Bluff Seam horizon; but in N.S. 146 and 147 it occurs practically on top of the Blackheath Sandstone Member. Borehole N.S. 138, drilled on the northern boundary of the Rhondda area as part of the Whitwood programme (reported on by Hawkins, 1960), passed through the pink shale at about 150 ft., where it lay 30 ft. below the Aberdare Conglomerate horizon and 20 ft. above the Bluff Seam. An identical shale member occurs immediately below or interbedded with the Aberdare Conglomerate at the southern end of the Bundamba Anticline in the New Hope area (Hawkins, 1958B) and the adjacent Southern Cross No. 9 area (Staines, 1958).

Generally this distinctive shale bed lies up to 30 ft. under the conglomerate, but may also be interbedded with it or lie immediately above it. This evidence indicates that the shale has a closer affinity with the Aberdare Conglomerate or the equivalent sandstone than with the Blackstone Formation. Such a relationship raises the question of whether the unconformity separating the Aberdare Conglomerate formation from the Blackstone Formation lies at the base of the conglomerate bed (as generally supposed) or at the base of the "pink shale". In view of the transgressive nature of conglomerate deposits generally, these two units may form part of a transgressive deposit occupying a position in the Ipswich sequence which becomes progressively higher towards the north-west of the Bundamba mining district. Both formations require further investigation in the field and in bore cores in order to elucidate their exact stratigraphic relationship.

(ii) Bundamba Sandstone.—The Bundamba sandstones crop out in the Rhondda area in a strip about a quarter of a mile wide running from portions 275 and 273 in the north to R. 384 in the south. They overlie the Blackstone Formation which crops out to the west and are covered to the east by a belt of Tertiary sediments along the course of Six Mile Creek. Bouldery outcrops of sandstone beds caught up in

a sharp anticlinal fold east of N.S. 143 and 146 emerge from beneath the Tertiary in the north-eastern corner of the area. Elsewhere up to 650 ft. in thickness, the Bundamba sandstones are here represented by a maximum of about 400 ft. of strata, the remainder having been removed by erosion preceding deposition of the Tertiary formations. As in the Blackheath area (Hawkins, 1958A), this lower section of 400 ft. comprises interbedded sandstone, siltstone and shale in such proportions that the lithology resembles that of the underlying coal measures. The massive white siliceous sandstones of the upper section of the Bundamba sandstone are not represented in the area. The sandstones range from fine- to coarse-grained and are commonly siliceous, the grains being bonded by argillaceous cement. They form prominent linear outcrops on the slopes of the ridges between Rhondda Colliery and Six Mile Creek.

(c) Booval Group

The Redbank Plains Formation and the Silkstone Formation comprise the Tertiary sequence in the Ipswich area. They have recently been redefined formally in terms of the Australian Code of Stratigraphic Nomenclature and have been grouped together as the Booval Group (Staines, 1960). The group is represented in the Rhondda area by a belt of Tertiary strata occupying the valley of Six Mile Creek.

(i) Redbank Plains Formation.—This formation is composed of mudstones, shales and fine sandstones lying at the base of the Tertiary sequence. The mudstones and shales are variously coloured grey-green, olive, purple, pink, brown and grey. The sandstones are generally soft, friable, light coloured and partly argillaceous. These sediments were cored in six boreholes of the Rhondda programme and comprise the major part of the Tertiary deposits in the area. The maximum thickness drilled was 173 ft. in N.S. 146.

In portion 282, the basal member is a light grey, slightly ferruginous, argillaceous sandstone. Its resemblance at outcrop to the Mesozoic sandstones is attributed to its having been formed by reconsolidation of detritus weathered from the underlying Bundamba sandstone. This feature is a characteristic of basal sandstones of the Redbank Plains Formation as observed elsewhere in the Ipswich district.

(ii) Silkstone Formation.—The Silkstone Formation consists typically of interbedded mudstones and shales of various colours, basalt flows and dolomitic limestones. Its only development in the Rhondda area is a partly weathered basalt flow penetrated by N.S. 145 to a depth of 63 ft. and outcropping nearby.

III. STRUCTURAL GEOLOGY

(a) Folding

The Bundamba Anticline is the dominant structural feature of the area. Its axis follows a somewhat sinuous N.N.W.–S.S.E. course through the Cooneana Estate area to the west. The strata of the Rhondda area form part of its eastern limb and dip fairly regularly to the east at angles averaging 10 deg. The dip flattens in the north-west as the axis of the anticline is approached and the Rob Roy Seam at its westernmost point of outcrop is almost horizontal. Dips calculated from underground levels in the Rob Roy Seam in this section are about 4 deg.

The attitude of the strata in boreholes east of the Rhondda workings indicates that the dip flattens in this direction also. This is due to the influence of an asymmetrical syncline, complementary to the Bundamba Anticline, whose axial region is broadly coincident with the course of Six Mile Creek. Structure contours on the Striped Bacon Seam (Figure 8) in part express this structure. Further east, beds of Bundamba sandstone rising abruptly from the flood plain of Six Mile Creek east of N.S. 143 and N.S. 146 dip westerly at angles ranging from 20 deg. to 50 deg. They lie on the western limb of a domal structure sharply folded about a N.N.W.–S.S.E. axis. The complete structure is shown on the geological map accompanying the report by Hawkins (1957) on the New Aberdare East mine area.

The tortuous line of outcrop of some seams, particularly in the north west of the area, is due not to any degree of folding but merely to the intersection of flat or gently dipping seams with a surface closely dissected by steep-sided gullies.

(b) Faulting

Rhondda workings in portions 275 and 273 terminate northwards against the *Rhondda Fault*. Underground exposures of this fault strike between east-west and W.N.W.–E.S.E. and dip steeply northwards. In Noblevale Colliery Jones No. 1 Tunnel it strikes N.W.–S.E. and dips north-east at angles averaging 60 deg. The positions at which it has been met in the several seams (see Figure 2) indicate that it is a complex zone of parallel faulting rather than a single displacement. The minimum displacement observed within the Rhondda area is approximately 40 ft. in Jones No. 1 workings. Comparison of the respective seam levels in Rhondda workings and in boreholes N.S. 144 and 141 indicates a downthrow to the north of at least 100 ft. in this locality. The difference in seam levels between boreholes N.S. 147 and N.S. 145 requires a downthrow of at least 360 ft. to the north. The fault originates in the New Whitwood No. 2 Tunnel workings and intensifies as it passes eastwards through the Jones No. 1 workings and the Rhondda workings respectively.

The geological records of boreholes N.S. 141 and N.S. 145 show major faulting in the area north of the Rhondda workings. N.S. 141 passed through several sections of faulted strata and in the last 100 ft. intersected partly brecciated coal measures dipping at angles up to 60 deg. N.S. 145 repeatedly passed through zones of fault breccia in the Ipswich Coal Measures. Comparatively minor faulting exists near the top and at the bottom of N.S. 144.

Reporting on the Whitwood area, Hawkins (1960) described a fault block of steeply dipping strata in portions 271, 272 and 267 bounded easterly by an arcuate zone of overthrusting. He also reported another zone of overthrusting penetrated by and extending northwards from N.S. 135. These two structures may parallel each other. If so, the Rhondda Fault would be related to the overthrust in N.S. 135 through bifurcating members curving around to the north-east. The displacement encountered underground would thus mark the southern limit of the deformation produced by the overthrust.

In the south of the Rhondda area the *Noblevale Fault* intersects the abandoned workings of Noblevale No. 1 Colliery Nos. 1 and 2 Tunnels. It strikes W.N.W.–E.S.E. and dips north-north-east at an unknown but probably steep angle. At its south-eastern end it is a reverse fault with a displacement of about 20 ft. The displacement decreases north-westerly and becomes nil in portion 281 (Figure 8). The Noblevale workings passed through the fault at this point of minimum disturbance. Further to the north-west the strata south of the fault steepen in proximity to a strike fault in the No. 3 Tunnel workings. This reverses the displacement of the Noblevale Fault and it becomes a normal fault with a maximum downthrow to the north of at least 150 ft. near N.S. 173. The influence of another strike fault in the No. 4 Tunnel workings causes the Noblevale Fault to die out quickly to the north-west. It is not mappable at the surface owing to the paucity of outcrops in this locality.

Noblevale No. 1 Colliery No. 3 Tunnel workings are limited on the south-east by a normal strike fault dipping at 40 deg. east-south-east. Mine plans indicate that the fault curves around from north-north-east to north-north-west as it approaches and meets the Noblevale Fault. Structure contours constructed on the Striped Bacon Seam, the seam worked in No. 3 Tunnel, suggest a displacement across the fault of about 50 ft.

No. 4 Tunnel workings on the Striped Bacon Seam and the co-extensive No. 5 Tunnel workings on the Rob Roy Seam were both limited to the dip by a nearly meridional fault. There is no record of the dip or the displacement of this fault, but the positions of the two sets of workings indicate it is vertical or nearly so. Comparison of levels on the Striped Bacon Seam in N.S. 173 and in No. 4 Tunnel workings, with the aid of structure contours, indicates an eastward drop of the order of 100 ft. near N.S. 173. The displacement diminishes rapidly northwards and there is no disturbance in the Rhondda workings to the near north. The fault is probably linked with the Noblevale Fault to the south and may be a northward continuation of the similar fault in the No. 3 Tunnel workings.

None of these faults is mappable at the surface. A small exposure of heavily faulted strata in a gully midway between N.S. 149 and N.S. 173 is near the intersection of the several faults in this vicinity.

A fault paralleling Redbank Plains Road near N.S. 150 is probably normal and south-westerly dipping and has an estimated displacement of 10 ft. It is a continuation of a zone of faulting in E. S. Cornwall Colliery to the south-east.

IV. COAL SEAMS

(a) General Properties of Coal

Coal in the seams of the Blackstone Formation is high volatile bituminous in rank. The fixed carbon values (calculated on a dry mineral-matter free basis using the Parr Formula) of five samples from the Four Feet Seam in boreholes N.S. 141 and 145 range from 64·3 to 65·7 per cent. and average 64·9 per cent. For twelve samples from the Striped Bacon Seam the values ranged from 62·2 to 64·9 per cent. and averaged 63·4 per cent. Six samples from the Rob Roy gave values ranging from 63·0 per cent. to 66·1 per cent. and averaging 64·3 per cent. The average of all samples is 63·85 per cent.

Moisture content in the Striped Bacon and Rob Roy Seams shows little variation from an average of 2·1 per cent. For the Four Feet Seam, the average value is 1·7 per cent.

Sulphur content normally ranges from 0·25 to 0·37 per cent. but reached 0·50 per cent. in one Four Feet Seam sample. The average is 0·31 per cent.

Coking tests carried out on three Striped Bacon samples and four Rob Roy samples indicated very poor coking properties. The coal is classified as firmly agglomerating to weakly coking and has a swelling index of about 3.

Coal of 25 per cent. ash from the Striped Bacon or Rob Roy Seams would produce approximately 10,500 B.T.U. per lb. Analysis of Four Feet seam samples indicates a slightly higher value of approximately 10,600 B.T.U. per lb.

Analysis of all borehole and underground samples included washability tests at specific gravities 1·4, 1·6 and 1·8. The detailed results of these tests are set out in Table I and are summarised in the section of this report dealing with reserves in the respective seams.

(b) Bluff Seam

The Bluff Seam is the uppermost seam of the Blackstone Formation in the Rhondda area. It is separated from sandstones equivalent to the Aberdare Conglomerate by from 0 to 50 ft. of shales. It has been exposed in several prospecting openings within the Rhondda property but, being of poor quality, has nowhere been worked.

Its identification at outcrop is confirmed by exposure of the characteristic indurated light grey to biscuit-coloured shale band occurring towards the top of the seam section. This band is from 9 to 12 in. thick and is diagnostic of the Bluff Seam throughout

the Bundamba mining district. Elsewhere within the district the Bluff Seam is about 30 ft. thick and the marker band lies from 6 to 10 ft. below the top of the seam. In the Rhondda area the seam is approaching its eastern limit and is less than half its normal thickness. The marker band is either at or near the top of the seam. Rhondda No. 2 Shaft at a depth of 67 ft. intersected a 14 ft. 7 in. section having the 11 in. marker band 7 in. from the top. Only three of the boreholes passed through the Bluff Seam—the northernmost three of the drilling programme. The thickest section was 17 ft. 8 in. in N.S. 141 at a depth of 196 ft. 11 in. The seam was 11 ft. 9½ in. thick in N.S. 145 at a depth of 555 ft. 7 in., and 10 ft. 7 in. thick in N.S. 144 at a depth of 93 ft. 0 in.

The best outcrop in the area is in a steep bank in the extreme south-western corner of portion 274. In a 14 ft. section of weathered coal and shale bands the foot thick marker lies 1 ft. from the top of the section. The seam is overlain by about 1 ft. of shale followed by medium-grained Bundamba sandstone. The seam can be traced continuously northwards from this exposure to a prospecting tunnel in the north-west of portion 273. Just north of this tunnel it is truncated by the Rhondda Fault whose northerly downthrow displaces it westwards into portion 275. Although its outcrop cannot be located with certainty, proof of the existence of the Bluff Seam in portion 275 is provided by its identification in boreholes N.S. 144 and N.S. 141. A bed of whitish shale identical with the marker band crops out one chain south of N.S. 144 and extends north-westerly up the hillside for a distance of nine chains. There is an exposure of what is probably the Bluff Seam in a gully 11 chains north-west of N.S. 144, but it cannot be directly linked with the whitish shale. This anomaly may be due either to undetected faulting or to mis-correlation of seam or whitish shale with the Bluff Seam.

In the southern half of the area the Bluff Seam is poorly exposed. There is coaly shale on the spoil dump of a prospecting tunnel in the west of portion 283A, but otherwise the only indication of the presence of the seam is the outcrop of the marker band.

A hitherto unidentified coal seam of poor quality is exposed in a cutting on Redbank Plains Road where it crosses Fernie Creek in Reserve 384. A 5 ft. section of weathered coal and shale is overlain immediately by a friable, slightly indurated, whitish shale band nearly 1 ft. thick. The similarity between this band and the Bluff marker leads the writer to regard this as an isolated outcrop of the Bluff Seam. The same seam is exposed in shallow diggings just south of the road.

Eastward from its outcrop the Bluff Seam deteriorates rapidly and cannot be recognised in N.S. 147 or N.S. 154. One foot of coal at 317 ft. in N.S. 151 may be a remnant of the Bluff. This eastward deterioration may possibly be due to removal of the upper members of the Blackstone Formation prior to deposition of the Bundamba Sandstone; but as the base of the latter formation is not everywhere sharply defined this suggestion cannot be verified.

(c) Four Feet Seam

The Four Feet Seam lies below the Bluff Seam at an interval ranging from 170 ft. in the north to as much as 280 ft. in the south. The latter thickness is abnormal and is caused by thickening of the intervening Blackheath Sandstone Member. The relationship is illustrated by a comparison of sections AA′ and CC′ (Figure 3). At outcrop the seam is overlain by 50 ft. or more of shale which is succeeded by the Blackheath Sandstone Member. In boreholes to the dip the seam is immediately overlain by the sandstone.

The seam is divisible into the Four Feet Top Coal and the Four Feet Main Seam, separated by a highly banded inferior section. Sections in seven boreholes average 20 ft. 2 in. in thickness. It is reported that the thickness is 16 ft. 6 in. in Rhondda No. 1 Shaft and 20 ft. in Rhondda No. 2 Shaft. A thickness of 24 ft. in the workings of Jones No. 1 Tunnel is probably the maximum for the area. In the vicinity of portion 282 in the south-east, the seam thins suddenly—in N.S. 89 only the lower section of the seam exists, 11 ft. 4 in. thick, and in N.S. 152 the seam has practically vanished from the sequence.

The Four Feet Seam outcrops as an oval-shaped outlier on the summit of Cooneana Ridge in portion 252. The south-western half of this exposure merges with the underlying Bergin Seam. The flat dip of the strata at this locality and the combined thickness of the two seams exaggerate the width of outcrop. The Four Feet Seam has been eroded from the eastern slopes of the ridge but outcrops again in portion 276. The outcrops of the Four Feet and Bergin Seams again approach each other in the neighbourhood of Brigenshaw's Adit (an inclined stone drive from the surface to the Rhondda workings) and merge near the top of a spur in the south of portion 277. The double seam is well-exposed near the filled-in entrance to Noblevale Colliery Bergin Tunnel. South of this outcrop it is largely concealed by creek alluvium but part of it can be seen in the collapsed entrance to No. 2 Tunnel of Noblevale No. 1 Colliery. An obscure coal crop in a gully near N.S. 163 is interpreted as part of the Four Feet Seam.

The Four Feet Seam was the first to be exploited in this area. Workings from a tunnel driven from the outcrop near the western boundary of portion 276 were subsequently developed from Rhondda No. 1 Shaft over a total area of some 135 acres. The Four Feet Top Coal was worked in an area of only about 18 acres south of Nos. 1 and 2 Shafts (Figure 2).

Noblevale No. 1 Colliery worked the main section of the Four Feet Seam extensively in the southern half of the area, and also extracted the Top Coal in parts of the area north of No.1 Tunnel.

In 1957 Jones No. 1 Tunnel was opened up to extract the Four Feet Seam in portion 275. It was initially driven on a 7 ft. section of the main seam but on passing through the Rhondda Fault was developed to work a 7 ft. 6 in. section of the Four Feet Top Coal.

The Four Feet Seam was identified in all drillholes in the area except N.S. 141, where it had been removed by faulting, and N.S. 152, where it was apparently non-existent. Sections of workable quality were found only in N.S. 144, 145 and 151. It is expected that the only section which will be worked is that in N.S. 144, since N.S. 145 lies in an area of complex faulting and N.S. 151 lies in an inaccessible embayment between the old Rhondda and Noblevlae No. 1 workings.

(d) Bergin Seam

The Bergin Seam may lie immediately beneath the Four Feet Seam so as to form with it a single continuous section of coal, or it may be separated from it by as much as 80 ft. of strata. The combined seams outcrop at the summit of Cooneana Ridge and at the entrance to Noblevale Colliery Bergin Tunnel. North-east of a line joining these two points the two seams are separated by a shale bed which progressively thickens and develops into a massive sandstone, as described in the section of this report dealing with the Blackstone Formation. Denmead (1955) reports that only 5 ft. 6 in. of shale separate the Four Feet and Bergin Seams in the southern part of the Rhondda Bergin workings. Notations on a plan of the Noblevale Bergin Tunnel workings state that the interval is 11 to 12 ft. at the face of the main tunnel and at least 16 ft. towards the south of the workings.

The outcrop of the Bergin Seam has been followed from the northern boundary of portion 277 along a tortuous course around the crest of Cooneana Ridge and down the spurs and gullies on the eastern fall of the ridge, as far as the entrance to Noblevale Colliery Bergin Tunnel. Soil and alluvium obscure it further south from this point. As underground evidence suggests that it deteriorates fairly rapidly in this direction it is assumed that it disappears temporarily from the sequence in the southern half of portion 280.

The sandstone lens which occupies the Four Feet-Bergin interval in portion 277 lies immediately above the Bergin Seam in several sections exposed by collapse of the old Rhondda workings. At outcrop it has "washed out" the seam over a length of at least six chains. The seam is also exposed as a small elliptical inlier in a steep-sided gully in the north of portion 277.

As exposed in underground workings the Bergin Seam attains a maximum thickness of nearly 14 ft. divided into two nearly equal sections by 18 in. of coal and stone bands. Both top and bottom sections were worked in Rhondda Colliery but both deteriorated rapidly eastwards (Denmead, 1955). In N.S. 147, 14 chains east of the workings, the seam has vanished from the sequence. It is reported that north of the main tunnel in the Noblevale Bergin Tunnel workings the top and bottom sections were each 6 ft. thick and were separated by 2 ft. of stone. South of the tunnel the "tops" were absent and the "bottoms" had thinned to 3 ft. To the east N.S. 151 and N.S. 146 show only coaly shale at the position in the sequence where the Bergin Seam would be expected.

An east-west zone of non-deposition is indicated by the fact that none of the boreholes across the south of the Rhondda area and none of the boreholes across the north of the adjacent Bonnie Dundee area show any sign of the Bergin Seam.

(e) Striped Bacon Seam

Unlike the Bergin, the Striped Bacon Seam persists over the whole area, underlying the Four Feet Seam at an interval ranging from 90 ft. in N.S. 143 to 180 ft. in N.S. 148. Where the Bergin Seam exists the Striped Bacon lies from 60 to 80 ft. below it. In No. 1 Shaft the interval, pavement to roof, is 62 ft. 6 in., and the Striped Bacon is 8 ft. at a depth of 233 ft. 9 in. Normal sections of the seam in nine drillholes average 7 ft. 10 in. in thickness. The working thickness ranges from 7 ft. to 7 ft. 6 in.

Distinctive shale bands divide the seam into four sections:—

(i) The uppermost section averages about 2 ft. in thickness and is made up of fairly clean coal with only a few thin shale bands.

(ii) About 2 ft. from the roof of the seam there is a 1 in. to 3 in. band of grey or fawn shale, and 9 to 12 in. below it another band of similar thickness and appearance. In the north of the area, in both workings and drillholes, these two bands are separated by partly inferior coal which may contain further thin shale bands. Towards the south of the workings this section deteriorates and the shale bands thicken rapidly at the expense of the coal. It is 1 ft. 1½ in. thick in sample R/SB3 and increases to 3 ft. 0½ in. in sample R/SB4 and further to 4 ft. 7½ in. in N.S. 154 (Figure 9). It reaches 9 ft. 5 in. in N.S. 89 and 10 ft. 9 in. in N.S. 173. The top 2 ft. of coal is then split away from the main section of the seam and does not appear at all in holes N.S. 150, 163 and 92. Deterioration and thickening of this coal and shale section were largely responsible for cessation of mining in the southern levels of the Rhondda dip workings.

(iii) The next division of the seam ranges in thickness from 2 ft. 6 in. to 3 ft. 9 in. and persists throughout the area. Up to six shale bands from ½ in. to 4 in. thick may occur in the otherwise clean coal. The basal fawn shale band is a

characteristic marker in the Striped Bacon Seam; it is generally 3 or 4 in. thick and puggy or leathery in the bottom ¾ in. It is not represented however in the sections cored in N.S. 141, 145 and 147 in spite of their proximity to mine workings where it forms the floor of the section worked.

(iv) The lowest section of the Striped Bacon Seam is generally about 2 ft. thick. It reaches 2 ft. 3 in. in N.S. 154 and 4 ft. 6 in. in N.S. 152 but does not appear in the northernmost drillholes in the area. It is unworkable in the northern half of the Rhondda dip workings but presents a section of good clean coal in a number of the southern faces. It contains a few 1 in. shale bands and may deteriorate in part to carbonaceous shale.

Variations in the component sections of the Striped Bacon Seam are depicted graphically in Figure 9.

In Rhondda Colliery the section worked in the rise workings and in the northern half of the dip workings comprises sections (i), (ii) and (iii). In the southern half of the dip workings the whole seam is extracted, except on the southern margins where only sections (iii) and (iv) can be economically mined owing to the deterioration and thickening of section (ii).

Drillhole sections show a progressive southward increase in ash content of the seam. It ranges from 27 per cent. in the northern holes to 43 per cent. in the south. The average ash content, weighted by thickness, of five drillhole samples and two underground samples within the area of reserves was calculated as 33·8 per cent.

Noblevale No. 1 Colliery No. 3 Tunnel also worked the Striped Bacon Seam. At the time of working the identity of the seam was in doubt, but was regarded by A. K. Denmead (1955) as the middle portion of the Four Feet Seam. B. W. Hawkins (1958) demonstrated however that the section was almost identical with the Striped Bacon Seam in N.S. 92. Subsequent drilling of N.S. 150 (a redrill of N.S. 149 which had passed through a cavity in the old workings) and N.S. 163 (part of the Cooneana Estate drilling programme) confirmed beyond any doubt the identity of the seam as the Striped Bacon. Only the lower two divisions of the seam are present.

Noblevale No. 1 Colliery No. 4 Tunnel workings were described by A. K. Denmead (1955) as being on an unnamed seam in the Cooneana Formation, as he considered it was too far below the Four Feet Seam to be in the Blackstone Formation. When No. 5 Tunnel was later opened up on a seam 30 to 40 ft. below the No. 4 Tunnel seam it became evident that the two seams were the Striped Bacon and Rob Roy respectively, because of this characteristic stratigraphic relationship between them. A section of the No. 4 Tunnel seam sampled in part by Denmead* corresponds band for band in divisions (iii) and (iv) of the seam with mine section R/SB4* measured by the writer, and also with the Striped Bacon Seam in N.S. 173.

The outcrop of the seam is displaced by a steep N.E.–S.W. fault in the north of portion 252. From here it follows a tortuous course around the deeply incised north-western slopes of Cooneana Ridge and after crossing the ridge near N.S. 166 runs down the eastern slope to a creek bank near Palmer's Shaft where a section of part of the seam could be measured.* The seam crops out again in a gully near N.S. 165 where another section was measurable.* From here it continued across the creek to Noblevale No. 1 Colliery No. 4 Tunnel. The S-shaped course of the outcrop from this tunnel to the Redbank Plains road is produced partly by topography and partly by changes in strike resulting from the Noblevale Fault and associated faults.

(f) Rob Roy Seam

The Rob Roy Seam lies below the Striped Bacon Seam at an interval which ranges progressively from 80 ft. in the far north of the area to 20 ft. in a number of boreholes in the south; it averages 40 ft. The interval is normally occupied by shales, but intercalated sandstone lenses are responsible for its northward thickening. Below the Rob Roy and above the typical sandstone of the Cooneana Formation there lie from 10 to 25 ft. of shale and siltstone.

The seam reaches a maximum thickness of 20 ft. 4½ in. in N.S. 147, and a minimum of 3 ft. 1 in. in N.S. 148. The exceptional interval of over 70 ft. in N.S. 141 is only an apparent thickness due to steep dips and duplication by faulting. Only N.S. 146 intersected a possibly workable section—the bottom 4 ft. 8 in. of the 11 ft. 8 in. section. The working section in Rhondda Colliery ranges from 4 ft. 7 in. to 6 ft. 3 in. It is characterised by a 10 to 15 in. section of inferior coal with interbedded shale bands which lies 1 ft. 6 in. to 2 ft. from the roof.

Across the centre of the area the Rob Roy Seam splits into two sections. The upper section constitutes the working section in Rhondda Colliery. It is separated from the lower section by a bed of shale which is 6 ft. 5 in. thick in N.S. 167, 2 ft. 10 in. towards the north of portion 277, 3 ft. 9 in. in the centre of portion 277 and 11 ft. near the Rhondda Air Shaft.

Where it is exposed underground near the Air Shaft the lower section is reported by Mr. P. Grabbe, Superintendent of Collieries, to be 10 ft. 10 in. thick and to include fourteen stone bands from ½ in. to 3 in. thick and one 7 in. stone band, together totalling 25 in. In the rise workings an interior shaft from the floor of the working seam has been sunk through the

*Detailed section recorded at Geological Survey.

top 7 ft. 8 in. of this seam.* It contains about twelve stone bands totalling approximately 15 in. N.S. 167 intersected a 9 ft. 8 in. section in the same seam. This lower section of the Rob Roy Seam disappears fairly quickly to the south and is unrepresented on section BB′ (Figure 3).

The Rob Roy Seam is worked in Rhondda Colliery and is reached from the Striped Bacon Seam workings by a westerly stone drive from near the bottom of No. 1 Shaft. It was also worked in Noblevale No. 1 Colliery No. 5 Tunnel but because of faulting the workings were not extensive. The section worked is not known. In N.S. 173 near the south-eastern extremity of the workings the seam was 4 ft. 7½ in. thick and contained workable coal in the top 2 ft. 7½ in.; this must be the No. 5 Tunnel working section.

The outcrop of the Rob Roy Seam closely parallels that of the Striped Bacon Seam throughout its length. In portions 249, 250 and 251 the two sections of the seam have been mapped, but the points at which they merge are not readily definable.

Erosion in a gully south-east of N.S. 167 has produced a sub-triangular outcrop of the top section of the seam.

Brown's Shaft, near the southern head of this gully, was sunk to a depth of 56 ft. through two sections of coal (6 ft. at 23 ft. and 4 ft. 8 in. at 40 ft. 6 in.) which are the two parts of the Rob Roy separated by 11 ft. 6 in. of shale.

Palmer's Shaft commenced near the crop of the Striped Bacon Seam in the same watercourse and at a depth of 54 ft. 5 in. met 6 ft. 6 in. of coal which is undoubtedly the working section of the Rob Roy Seam. The shaft reached a depth of 64 ft. and in the bottom 1 ft. 8 in. passed through coal and stone representing part of the lower section of the seam.

V. COAL RESERVES

Reserves have been calculated on the usual assumption that workable coal as exhibited in a borehole section extends for an arbitrary distance of 5 chains beyond the borehole. Where a section is only of marginal quality or where there is direct evidence that a five-chain extension of reserves is unjustified, judgement is exercised accordingly in delineating reserves. No deduction is made for coal rendered unavailable by faulting within the area of reserves, or for coal left in pillars or lost through other causes during mining.

Measured reserves have been calculated for the Striped Bacon Seam only and the area within which they lie is shown on Figure 2. Boreholes indicate that there is extractable coal remaining also in the Four Feet and Rob Roy Seams, but for reasons outlined below quantities cannot be calculated.

*Detailed section recorded at Geological Survey.

(a) Four Feet Seam

None of the holes to the dip of the Rhondda and Noblevale No. 1 workings found a workable section in this seam, with the exception of N.S. 151 which was drilled in an embayment between the two sets of workings. The Four Feet Top Coal and the Four Feet Main Seam here total 19 ft. 11 in. in thickness and though not analysed appear to consist of good clean coal. As the quantity of workable coal would be comparatively small and as access to it would have to be through the abandoned workings it may be written off as being unavailable.

The Four Feet Seam in portion 275 was tested by N.S. 141 and N.S. 144 prior to commencement of Jones No. 1 Tunnel. In N.S. 141 the seam was faulted and only a very incomplete section was obtained, insufficient to warrant analysis. N.S. 144 intersected a section totalling 24 ft. 7 in. The top 7 ft. 2½ in. contains 22·7 per cent. ash and the bottom 10 ft. 3¾ in. 33·9 per cent. ash. The top section is now being worked in the Jones No. 1 Tunnel workings. In N.S. 138, on the boundary between the Whitwood and Rhondda areas, the Four Feet Seam totals 21 ft. 8 in. The top 6 ft. 7 in. contains 24·6 per cent. ash and the bottom 8 ft. 4 in. 29·6 per cent. ash. In view of the quality of the seam in N.S. 145 (33·9 per cent. ash in the top 5 ft. 0½ in. and 29·1 per cent. ash in the bottom 6 ft. 4½ in.) it is probable that workable coal continues eastwards from N.S. 144 at least as far as N.S. 141; but mine development in this direction may be limited by faulting before the eastern boundary of portion 275 is reached.

There is obviously a quantity of fair quality coal north of the Rhondda Fault in portion 275 but it cannot be measured as there are only two drillhole sections in it.

(b) Bergin Seam

The Bergin Seam has been worked out and there are now no reserves remaining.

(c) Striped Bacon Seam

Reserves estimated in the Striped Bacon Seam lie wholly to the dip of the Rhondda workings on that seam. Embracing holes N.S. 147, 143, 146, 148 and 151, they cover an area of 190 acres. The assumed eastward course of the Rhondda Fault has been taken as the northern limit of reserves inasmuch as this major feature precludes northward development from existing workings. The southern limit is determined by increasing ash content and thickening of stone bands in the seam south and west of N.S. 148.

It is desirable to include in the reserves quoted for the Rhondda area certain reserves which lie east of Six Mile Creek within C.M.L. 328 held by New Whitwood Collieries Pty. Ltd. They occupy an area of 49 acres surrounding N.S. 143. Because of the

absence of Striped Bacon Seam reserves in the New Aberdare East area to the east and north-east, there is little likelihood of this block of coal being worked from the east. Faulting in the Rhondda Fault zone would prevent entry from the north. Therefore the obvious method of exploitation is by development of the existing Rhondda workings, provided an agreement between the two companies could be reached.

Based on five borehole sections and two underground sections the workable section of the seam within the area of reserves averages 7 ft. 6 in. in thickness and has a weighted average ash content of 33·8 per cent. The average specific gravity is 1·58. Gross reserves within the 190 acres amount to 2,700,000 tons.

Because of the high ash content beneficiation will be essential to produce a marketable product. Washability tests were therefore carried out on all samples. It is estimated that by washing the coal at 1·8 specific gravity 25·6 per cent. would be discarded and the average ash would be reduced to 20·0 per cent. Net reserves then amount to 2,000,000 tons.

The area of measured reserves in the adjacent Whitwood area (Hawkins, 1960) was not extended into portion 275 as it is part of the Rhondda company's leases. It may be assumed however that workable coal does exist here. N.S. 138 passed through a 5 ft. 10 in. section of the seam containing 32·1 per cent. ash and N.S. 141 passed through an 8 ft. 2 in. section containing 27·7 per cent. ash. Coal of similar quality undoubtedly lies between these holes and the Rhondda Fault; but as N.S. 144 did not reach the seam quantities cannot be estimated.

The Striped Bacon Seam is also of workable quality in N.S. 145 (a 7 ft. 3½ in. section contains 27·1 per cent. ash), but because of complex faulting north of the Rhondda Fault and east of N.S. 141, which would preclude mining, no reserves can be estimated.

(*d*) Rob Roy Seam

Drilling in the Rob Roy Seam was disappointing in that no workable section of coal was discovered which would allow reserves to be estimated. The only apparently workable section was the bottom 4 ft. 8 in. of the seam in N.S. 146, but its lateral extent is unknown.

Reserves probably exist in portion 275 north of the Rhondda Fault. In view of the workable section of 5 ft. 10¾ in. carrying 30·7 per cent. ash at the top of the seam in N.S. 138 (Hawkins, 1960) it is likely that workable coal persists between this hole and the Rhondda workings. Heavy faulting in the vicinity of N.S. 141 would, as in the upper seams, form an eastward barrier to mining operations. This faulting and the failure of N.S. 144 to reach the Rob Roy Seam prohibit the estimation of reserves in this area.

The lower section which splits off the Rob Roy Seam is composed of banded coal which, after washing, should be marketable. Current prospecting of this section from the Rob Roy workings may ultimately provide sufficient information to enable the quantity and quality of reserves to be calculated.

VI. CONCLUSIONS

Drilling in the Rhondda area has proved reserves of coal only in the Striped Bacon Seam, which is currently being exploited in Rhondda Colliery. Total "measured" reserves amount to 2·7 million tons carrying 33·8 per cent. ash and lie to the dip of existing workings. Washability tests indicate that by washing the coal at specific gravity 1·8 to reduce the high ash content 25·6 per cent. would be rejected, leaving 2·0 million tons carrying only 20·0 per cent. ash.

Additional tonnages of extractable coal are indicated in the Four Feet, Striped Bacon and Rob Roy Seams in the part of portion 275 lying north of the Rhondda Fault. Available information is insufficient for estimation of reserves but indicates that faulting will form an eastward barrier to mining.

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TABLE 1

WASHABILITY TESTS

Seam	Drillhole No.	Mine Section No.	G.S. No.	Ash %	Floats S.G. 1·4		Floats S.G. 1·6		Floats S.G. 1·8		Sinks S.G. 1·8		Composite of Floats Ash %
					Weight %	Ash %	Weight %	Ash %	Weight %	Ash %	Weight %	Ash %	
Four Feet Top Coal	N.S. 144		545/56	22·7	61·2	10·6	14·9	23·8	7·5	38·8	16·4	67·4	15·4
Four Feet Main Seam	N.S. 144		546/56	33·9	45·9	9·1	16·7	26·7	6·2	49·2	31·2	70·0	17·2
Four Feet Top Coal	N.S. 145		547/56	33·9	36·8	11·4	30·5	28·9	7·0	44·5	25·7	70·5	22·0
Four Feet Brushing Bands ..	N.S. 145		548/56	46·0	27·2	10·0	16·1	27·9	11·4	44·0	45·3	71·7	24·1
Four Feet Main Seam	N.S. 145		549/56	29·1	47·9	9·4	20·2	24·4	10·8	40·4	21·1	71·0	18·5
Striped Bacon	N.S. 141		740/56	27·7	57·4	11·8	21·6	29·0	4·5	49·9	16·5	76·9	17·0
Striped Bacon	N.S. 143		741/56	27·6	53·0	11·9	24·7	29·4	4·5	52·2	17·8	76·6	17·4
Striped Bacon	N.S. 145		742/56	27·1	47·4	11·1	16·2	30·6	11·3	49·9	25·1	75·5	22·0
Striped Bacon	N.S. 146		743/56	40·5	41·5	13·8	27·0	29·9	4·2	48·8	27·3	78·7	21·6
Striped Bacon	N.S. 147		744/56	30·0	54·9	11·3	15·4	27·1	9·7	45·5	20·0	76·9	18·5
Striped Bacon	N.S. 148		745/56	42·4	19·0	13·9	22·5	27·4	8·7	43·1	49·8	75·7	25·1
Striped Bacon	N.S. 151		746/56	33·3	54·3	13·9	26·5	27·8	8·2	46·7	11·0	76·0	22·0
Striped Bacon	N.S. 154		354/57	43·0	49·5	14·5	13·5	31·0	8·9	42·8	28·1	78·0	21·7
Striped Bacon		R/SB2	1504/58	29·2	44·2	8·4	23·6	23·6	6·5	40·7	25·7	74·1	16·0
Striped Bacon		R/SB3	1505/58	33·3	27·0	10·9	34·0	22·3	10·5	41·5	28·5	73·3	20·8
Rob Roy		R/RR1	1507/58	29·2	46·1	8·3	25·8	28·8	9·7	43·7	18·4	71·5	18·8
Rob Roy		R/RR2	1508/58	32·7	38·3	9·1	24·7	26·6	12·2	44·1	24·8	74·5	20·4
Rob Roy		R/RR3	1509/58	41·4	20·7	7·2	22·8	24·2	16·1	42·7	40·4	65·9	22·9

S. G. Reid, Government Printer, Brisbane

FIG. 1

DEPARTMENT OF MINES, QUEENSLAND
PLAN OF

P.D.T.S. Nos.11, 12 & 14 Mine Areas
RHONDDA
IPSWICH COALFIELD

Parish of Goodna · County of Stanley
Showing geology. topography and boreholes
To accompany report by H.R.B. Staines, B.Sc., Geologist
Survey by Ewan Cowley, Asst. Surveyor

SCALE OF CHAINS 10 0 10

LEGEND

QUATERNARY — Alluvium
TERTIARY — Basalt; Redbank Plains Formation
TRIASSIC — Bundamba Group; Blackstone Formation; Cooneana Formation

Geological Boundaries: Established bdry posn. accurate; approx.; concealed; Inferred, probable or indef. bdry.

Faults: Established fault posn accurate; approx.; concealed; Inferred, probable or indef. fault

LOCALITY MAP
SCALE OF MILES 2½ 2 1½ 1 ½ 0 2½

EXPLANATION
Coal seam at surface; Outcrop; Diamond Drillhole; Percussion Drillhole; Working colliery; Abandoned colliery; Adit; Shaft; Section Line A——A'; COLLIERY; COLLIERY A

SURVEY DATA
Elevations in feet on State Datum. Grid of 20 chain co-ordinates. Meridian of Grid is True North at origin, an arbitrary point being bolt in concrete block on Road near angle in Eastern boundary of Sub 7, Por 213, Parish of Ipswich

FIG. 2

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

P.D.T.S. Nos 11, 12 & 14 MINE AREAS

RHONDDA

IPSWICH COALFIELD

Parish of Goodna · County of Stanley

Showing mine workings, limits of reserves and boreholes

To accompany report by H.R.E. Staines, B.Sc., Geologist

Survey by Ewan Cowley, Asst. Surveyor

SCALE OF CHAINS

10 0 10

EXPLANATION

Working Colliery — JONES No1
Abandoned Colliery — ABERDARE A
Fault in Workings
Diamond Drillhole — N.S. 107
Shaft
Adit

Workings on Four Feet Top Coal
Four Feet Seam
Bergin Seam
Striped Bacon Seam
Rob Roy Seam
Measured Reserves on S. Bacon Seam
Sample taken in mine workings on Striped Bacon Seam — R/SB 2
Sample taken in mine workings on Rob Roy Seam — R/RR 2

P.D.T.S. Nos. 12 & 14 MINE AREAS

P.D.T.S. No. 11 MINE AREA

NEW WHITWOOD No 1 A
NEW WHITWOOD No 2
JONES No 1
RHONDDA
Rhondda No 1 Sh.
Rhondda No 2 Sh.
NOBLEVALE A
Bergin Tunnel
NOBLEVALE No 1 No 4 TUNNEL A
NOBLEVALE No 1 No 5 TUNNEL A
No. 1 Tunnel
NOBLEVALE No 1 A
No. 2 Tunnel
NOBLEVALE No 1 No 3 TUNNEL A
Boundary of Rhondda Leases

N.S. 135 R.L. Coll. 117·99 R.L. Surf. 116·90 R.L. Btm. -668·34
N.S. 138 R.L. Coll. 156·20 R.L. Surf. 152·10 R.L. Btm. -523·80
N.S. 141 R.L. Coll. 107·90 R.L. Surf. 106·70 R.L. Btm. -584·52
N.S. 144 R.L. Coll. 163·20 R.L. Surf. 162·10 R.L. Btm. -247·05
N.S. 145 R.L. Coll. 95·70 R.L. Surf. 94·20 R.L. Btm. -873·30
N.S. 142 R.L. Coll. 91·23 R.L. Surf. 87·53 R.L. Btm. -49·02
N.S. 147 R.L. Coll. 82·85 R.L. Surf. 81·25 R.L. Btm. -802·15
N.S. 143 — A′ R.L. Coll. 87·63 R.L. Surf. 83·15 R.L. Btm. -728·87
N.S. 169 R.L. Coll. 152·30 R.L. Surf. 151·23 R.L. Btm. 25·62
N.S. 166 R.L. Coll. 277·60 R.L. Surf. 276·50 R.L. Btm. 230·10
N.S. 167 R.L. Coll. 268·80 R.L. Surf. 267·80 R.L. Btm. -58·20
N.S. 164 R.L. Coll. 213·00 R.L. Surf. 211·75 R.L. Btm. -21·75
N.S. 165 R.L. Coll. 184·70 R.L. Surf. 183·58 R.L. Btm. -18·38
N.S. 151 R.L. Coll. 152·60 R.L. Surf. 151·20 R.L. Btm. -649·82
N.S. 146 R.L. Coll. 90·65 R.L. Surf. 86·65 R.L. Btm. -868·65
N.S. 156 R.L. Coll. 167·30 R.L. Surf. 166·11 R.L. Btm. 68·20
N.S. 93 R.L. Coll. 225·90 R.L. Surf. 221·36 R.L. Btm. -2534·10
N.S. 155 R.L. Coll. 178·75 R.L. Surf. 177·50 R.L. Btm. -82·75
N.S. 161 R.L. Coll. 192·75 R.L. Surf. 191·50 R.L. Btm. -128·00
N.S. 173 R.L. Coll. 167·32 R.L. Surf. 167·01 R.L. Btm. -67·60
N.S. 154 R.L. Coll. 148·35 R.L. Surf. 147·50 R.L. Btm. -473·78
N.S. 148 R.L. Coll. 88·80 R.L. Surf. 85·06 R.L. Btm. -811·20
N.S. 157 R.L. Coll. 175·85 R.L. Surf. 174·60 R.L. Btm. 5·68
N.S. 149 R.L. Coll. 208·20 R.L. Surf. 207·50 R.L. Btm. 58·30
N.S. 159 R.L. Coll. 230·00 R.L. Surf. 229·80 R.L. Btm. 101·33
N.S. 160 R.L. Coll. 233·12 R.L. Surf. 232·05 R.L. Btm. -36·63
N.S. 150 R.L. Coll. 215·55 R.L. Surf. 214·20 R.L. Btm. -56·95
N.S. 163 R.L. Coll. 193·28 R.L. Surf. 191·88 R.L. Btm. -401·39
N.S. 92 R.L. Coll. 139·71 R.L. Surf. 138·80 R.L. Btm. -392·23
N.S. 89 R.L. Coll. 191·44 R.L. Surf. 189·44 R.L. Btm. -858·56
N.S. 152 R.L. Coll. 94·95 R.L. Surf. 94·20 R.L. Btm. -893·47

R/RR1 R/RR2 R/RR3 R/RR4 R/RR5 R/RR6
R/SB1 R/SB2 R/SB3 R/SB4 R/SB5

16000 N. 14000 N. 12000 N. 10000 N. 8000 N.

10000 E. 12000 E. 14000 E. 16000 E. 18000 E. 20000 E. 22000 E. 24000 E.

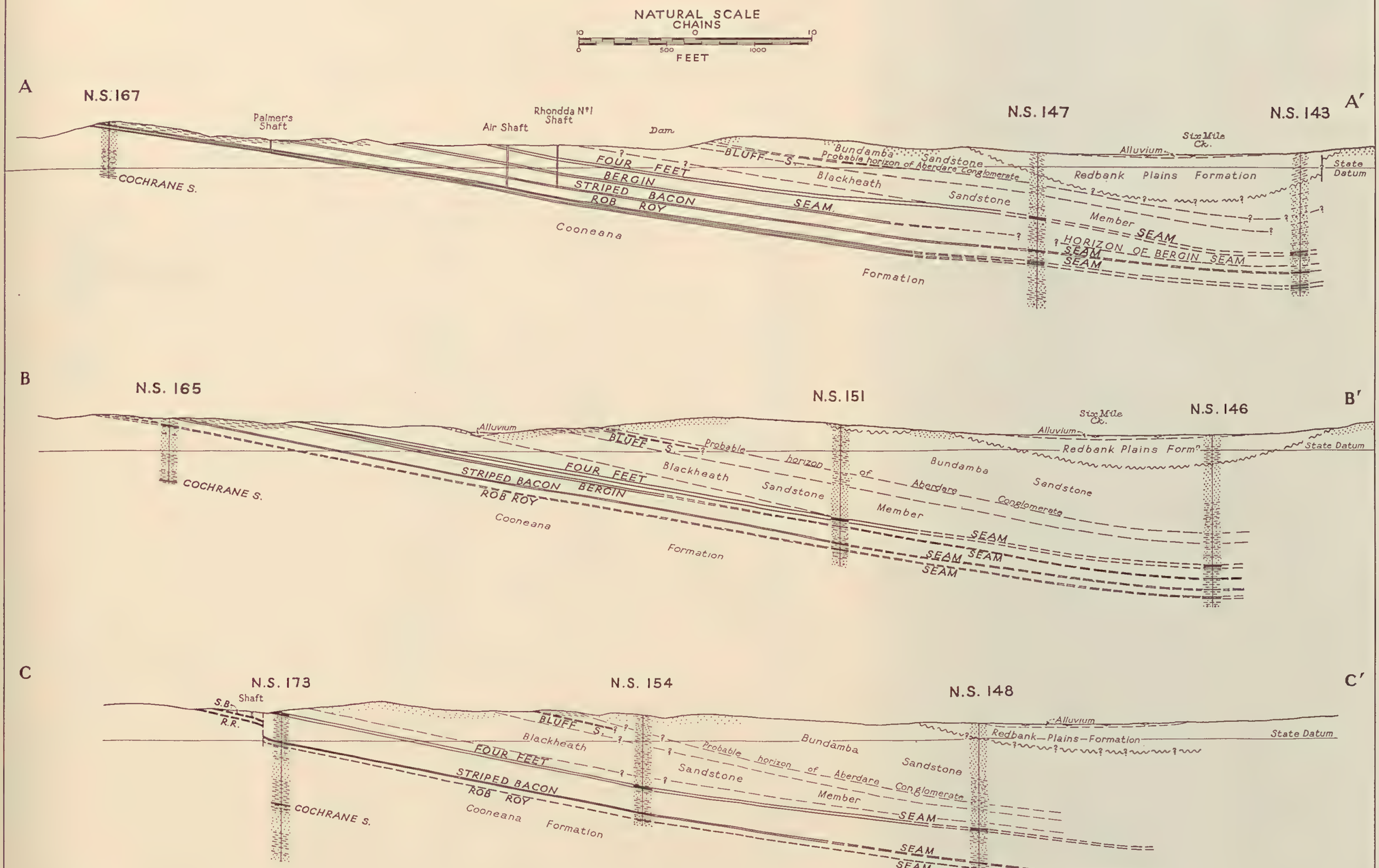
A A′ B B′ C C′

SURVEY DATA

Elevations in feet on State Datum. Grid of 20 chain co-ordinates. Meridian of Grid is True North at origin an arbitrary point being bolt in concrete block on Road near angle in Eastern boundary of Sub. 7, Por. 213, Parish of Ipswich.

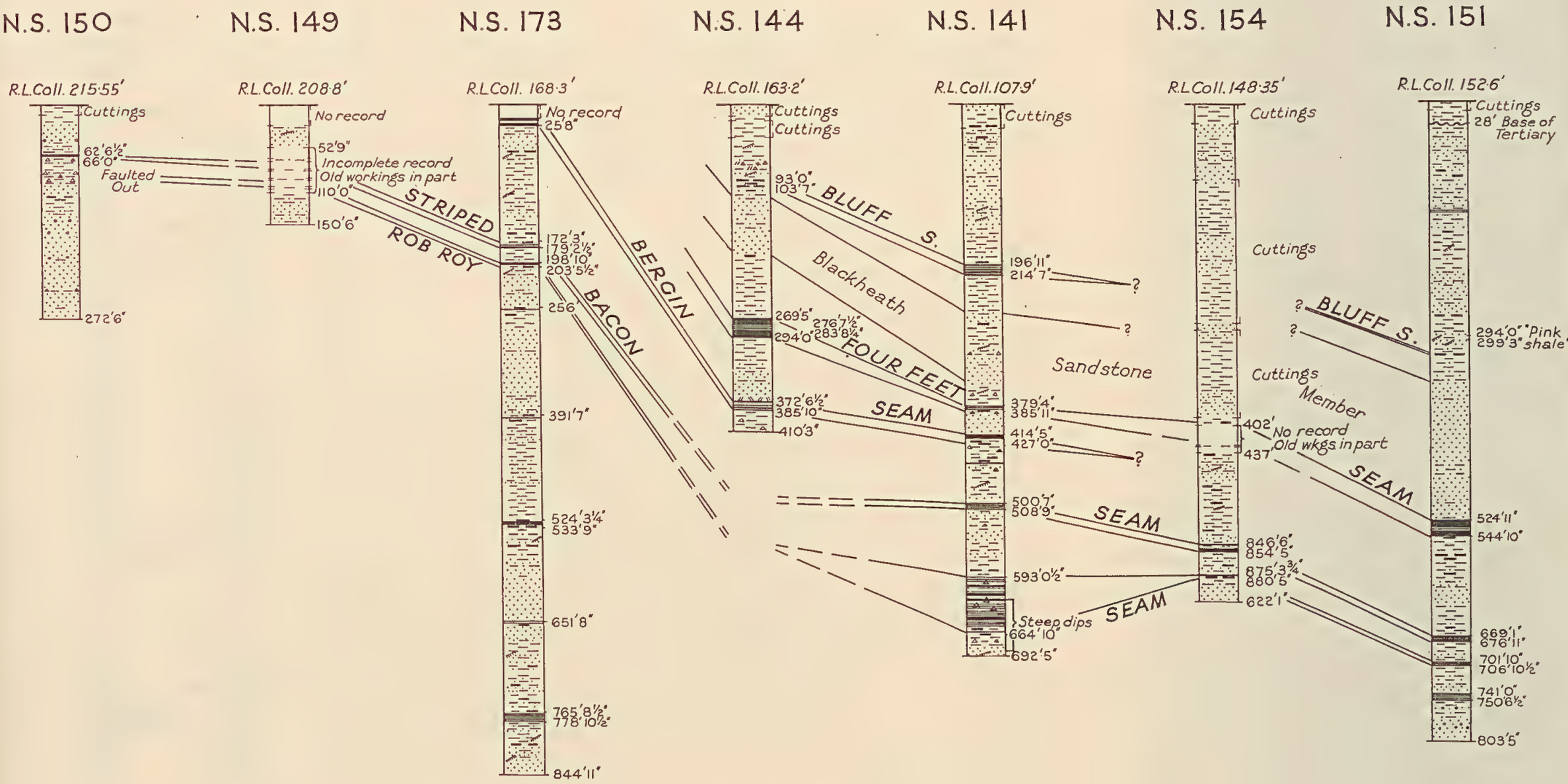
P.D.T.S. MINE AREAS Nos. 11.12 & 14 RHONDDA

CROSS SECTIONS



P.D.T.S. MINE AREAS Nos. 11, 12 & 14 RHONDDA

GENERALISED BORE SECTIONS

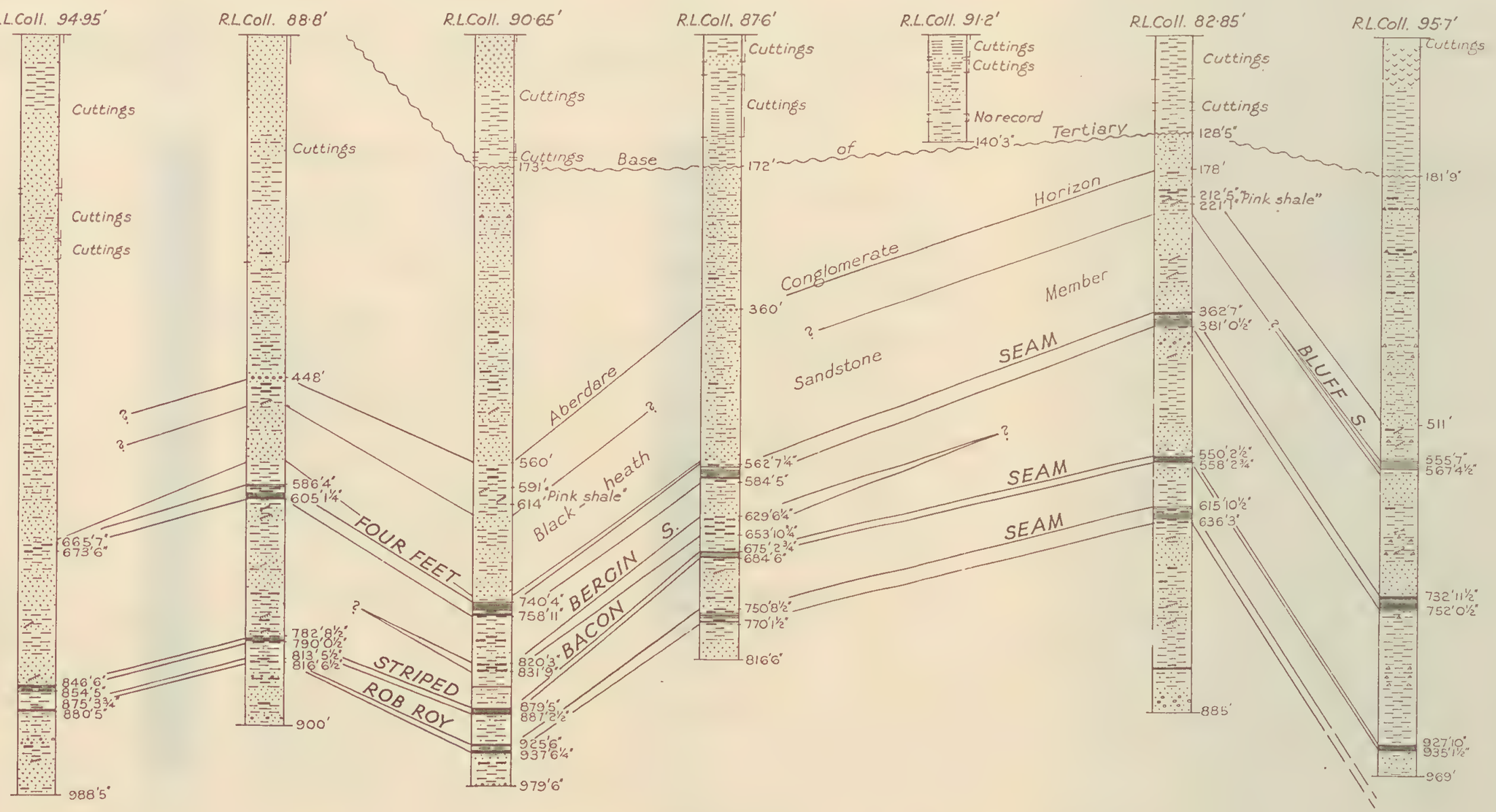


LEGEND

- mudstone
- shale
- siltstone
- sandstone
- pebbly sandstone
- conglomerate
- iron carbonate
- coaly shale
- fault breccia
- coal & shale bands
- coal
- basalt
- basic intrusive

P.D.T.S. MINE AREAS Nos. 11, 12 & 14 RHONDDA

GENERALISED BORE SECTIONS



LEGEND

- mudstone
- shale
- siltstone
- sandstone
- pebbly sandstone
- conglomerate
- iron carbonate
- coaly shale
- fault breccia
- coal & shale bands
- coal
- basalt
- basic intrusive

FIG. 5

P.D.T.S. MINE AREAS Nos. 11, 12, & 14 · RHONDDA

DIAGRAMS OF FOUR FEET TOP COAL AND FOUR FEET SEAM

DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 144

Prox analysis Cal value, S, SG	Recovery Section percent	Sampled	Description
			Roof: med gy sh,
			269'5" 1"(pb) coal; 1" inf. coal, 2¼"(pb) coal; ¾" carb. sh; 2" coal; ¾" dk gy sh;
			1'1½" coal ← inf. coal in places;
			¼" carb sh.;
			11" coal;
			1" bluey; 1" coal; ⅛" bluey; 3¼"(bkn) coal, ½" m gy. sh.;
			6½" coal (bkn ⅛"-4");
			⅛" bluey;
			1'10½" coal (bkn. at 10½"-1'2½" & in btm. 3");
			¾" dk gy. sh;
			5¾" coal (bkn. top 1");
			276'7½" 7½" coal w. few large sh. lents.; 1" dk gy. sh; 1" coal; ¾ carb. sh.; ½" coal; 1" dk gy. sh.; 1½" carb. sh; 5½" coal w dk gy sh. lam.; ¼" dk. gy. sh; ½" coal; 2¼" carb. sh.; 3¾" coal ← inf. coal; 2¼" coaly sh, 1" dk gy sh, 1½" coaly sh, ¾" dk gy sh; ⅛" coal; 1½" carb. sh; 2" l gy. sh.; 3" inf. coal ← coal; 2" boulder; 2½" coal; ½" inf coal; 1¾" m gy sh; 1" pb coal; 1¼" carb. sh.; ½" m gy sh; 3¾" blk. sh. ← carb. sh; ¼" coal; 1½" pb carb sh; 8½" coal ← inf. coal; ¼" dk gy sh; 7½" inf. coal ← coal in btm. 2"; 1" m. gy. sh; 2½" coal;
			6½" (bkn) inf. coal & coal; 1" m. gy sh.; 3¼" fn. sh.; 1" coal; 1¾" fn. sh.; 1" carb. sh.; 1½" coal; 1¾" m gy sh;
			283'8¼" ¾" l gy – fn. sh; ¾" l. gy. puggy sh; 1" carb sh
			11" coal (bkn. btm. 3");
			3"(pb) carb. sh.; ⅛" dk gy sh.; 1" carb sh; 2½" coal; ¾" m. gy. sh.;
			11" coal;
			⅝" l.-med. gy. sh.; 2½" inf. c. ← coal; ½" m gy. sh, 5¼"(bkn) coal;
			2" l-med gy. sh; 1⅜"(bkn) coal; 2¼" m gy. sh w ½" carb sh ¾" fr btm,
			10½" coal;
			1½" boulder; 4½" coal; ⅛" m gy. sh;
			1'6" coal,
			1¼" boulder;
			1'3" coal (bkn. 8"-11") w. i. carb. nod. at 5"-8";
			2" dk ← med gy. sh.; 1¾" coal w ⅛" lens m gy. sh. at btm;
			1'0¾" coal ← inf. coal in places;
			2" m.-dk. gy. sh. w. i carb nodules;
			294'0" 6" coal (bkn. top 3");
			Floor: m gy. sh. ← slts in places.

Prox analysis Cal value, S, SG	Recovery Section percent	Sampled
Ad 22·7, SG 1·47		
On comp of floats:* M 1·7, V.M. 29·8, F.C. 53·1	95·7	545/56
Ad 15·4, Joules/gm 28120, BTU/lb 12100, S 0·50, S.G. 1·41		
Ad 33·9, SG 1·59		
On comp of floats:* M 1·7, V.M. 29·8, F.C. 51·3	98·6	546/56
Ad 17·2, Joules/gm 27630, BTU/lb 11890, S 0·29, SG 1·41		

Overall Recovery 97·8%

N.S. 145

Prox. analysis Cal value, S, SG	Recovery Section percent	Sampled	Description
			Roof: white co.sa.;
			732'11½" 1'6"(bkn) coal;
			1½"(pb) dk gy sh;
			1'2"(bkn) coal – some brecciated;
			1'3⅜" (bkn) coal (80%) and bluey, faulted;
			738'0" ¾" fn sh.; 3" brecc. coal w ¼" fn. sh.; 2"(b) fn sh w carb sh. lents, 3¼"(b) coal;
			4½"(b) brecc. coal & inf. coal w ½" fn. sh.; 2¾" carb sh. w ½" fn sh at 1"; 1¾ coal; ¾" l gy – fn. sh;
			3" coal; 1½"(pb) bluey; 2⅝" carb sh w two th bds br sh
			8¼"(bkn) coal ← inf. coal & bluey;
			4" coal (fractured); 2½" fn sh, 2½" carb sh & inf. coal, 1" fn sh.;
			1'5¾"(bkn) coal & inf coal w. 1" fn. sh. near btm.;
			744'3½" 2" dk gy. sh. w. carb sh. lam; 2" carb sh.; ½" fn. sh;
			1'7½" (pb top 1'4") coal ← inf. coal in places, w ¾" fn sh at 8" & 1" l br sh at 1'2";
			1" boulder;
			1'1" (pb 4"-11") coal, inf in pl,
			1" fn sh; ½" carb sh; 2"(bkn.) coal; 1"(bkn) fn. sh;
			3'2" (bkn) coal w. few bluey bands;
			750'8" 2" fn sh; ¾" dk gy sh, 1¼(b) fn sh & blk sh; ¾" carb sh, 2¾" coal ← inf. coal,
			752'0½" 7" (bkn) inf. coal;
			Floor gy sh

Prox analysis Cal value, S, SG	Recovery Section percent	Sampled
Ad 46·0, SG 1·74		
On comp of floats:* M 1·6, V.M. 27·8, F.C. 46·5	90·4	548/56
Ad 24·1, Joules/gm 24810, BTU/lb 10670, S 0·25, S.G. 1·50		
Ad 29·1, SG 1·54		
On comp of floats:* M 1·6, V.M. 29·6, F.C. 50·1	100	549/56
Ad 18·5, Joules/gm 27160, BTU/lb 11680, S 0·25, SG 1·43		

Overall Recovery 94·0%

* For washability tests see Table I

P.D.T.S. MINE AREAS Nos. 11, 12, & 14 · RHONDDA

DIAGRAMS OF STRIPED BACON SEAM · DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 141

Prox. analysis Cal.value, S, S.G.		Recovery Section percent	Sampled	Description
A%	27·7			
S.G.	1·52			
On comp. of floats:*				
M%	2·1			
V.M.%	29·3			
F.C.%	51·6			
A%	17·0			
Joules/gm	26920			
BTU/lb	11580			
S%	0·37			
S G	1·43	97·0	740/56	500'7" Roof: 1 gy. f sa.; 6"(bkn) coal; 2"(bkn) inf. coal; 2'1" coal (pb top 6") with ¼" dk-med gy sh. at 6" & ¼ med gy. sh at 1'2¾"; 1" dk. gy. sh; 7" coal; 1" dk gy sh; 5" inf coal → coal; 2½" med gy-fn sh; 1¼" coal; ½" m gy-fn. sh; 2" coal, ¾ carb sh; 3" coal → inf. coal, ¼ m gy-fn. sh.; 4" coal → inf. coal; 3¼" inf. coal; 1'6½" (p b. btm 1') coal; 1' m gy sh, 11" coal; 508'9" 1" boulder 5½" carb. sh. w. some coal lents.; Floor: dk gy. sh,

Overall Recovery 97·0%

N.S. 146

Prox. analysis Cal.value, S, S.G.		Recovery Section percent	Sampled	Description
A%	40·5			
S G.	1·65			
On comp of floats:*				
M%	2·1			
V.M.%	29·2			
F.C.%	47·1			
A%	21·6			
Joules/gm.	25560			
BTU/lb	11000			
S%	0·35			
S.G.	1·45	97·4	743/56	879'5" Roof: gy. slts.; 6" coal w br. sh. penny bds. at ½" & 3½"; 2" carb. sh.; 1½" coal; 1½" inf. coal; 2½" carb. sh.; 5" coal; 4" lbr → fn sh; ¼" crm sh, 1½" inf. coal, 1½" carb sh, 4½" coal → inf coal, w ½" m gy sh lens at 2", 1½ m. gy. sh; 1'4½" coal; ¾" (p b) l gy sh.; 6½ (p b) coal, some inf. w ½" lens carb sh at ½", 1" lenses fri • ch sh; 1½ (p b) coal, ¾ fn sh, 2¾ coal w carb sh bds at top & btm, 2'1 gy sh, 5½ coal w. ¼ lens carb sh. at 1", 2½" lbr → fn. sh.; ¼ crm. sh.; 2½ inf. coal; 6¼ coal; 2½ inf. coal; 1" coal; 8" inf. coal w few i. carb. nodules; 887'2½" 2" carb sh; 4¾ (p b) l gy slts. w irreg cb sh lam.; ¾" blk. sh, 1¾ coal ¼ calcite lacing, 2" carb. sh.; 1½ l gy. sh.; 2" blk. → carb sh; 4¾ f-med. gy. slts..

Overall Recovery 97·4%

N.S. 143

A%	27·6			
S.G.	1·51			
On comp of floats:*				
M%	2·0			
V.M.%	30·9			
F.C.%	49·7			
A%	17·4			
Joules/gm.	26,110			
BTU/lb.	11230			
S%	0·33			
S.G.	1·44	100	741/56	675'2¾" Roof: dk gy sh. 2" coal; 4½" carb sh w num coal lents, ¾" coal, 3½" dk gy slts, 676'3½" 1" coal, ½" carb sh; ½" m gy sh, 5¼" coal, ¾" med gy sh, 9¾ (p b) coal w ¼" m gy sh at 8½"; ½" m. gy. sh.; 1'4" coal w. ¼" bds. m gy. sh. at 5¼" & 6½" fr. top; 2½" bluey; 10" (p b) coal → inf. coal in places; 3" fn sh. w. carb. sh. lens at btm.; 2¾ coal; ½" fn sh; 1½" coal; 1½ dk. gy. sh; 1 coal; 1¼" carb. sh. w coal lam, 2'0¾" (p b. in top 1'0") coal w ¼" dk gy sh at 1'11½"; 683'0½" 1½" dk gy sh; 4¾ coal, 1 dk gy sh; ¾" coal w pcn bd sh in 1½" dk gy-carb sh; 1'4" coal, [mid 1½ dk gy sh; 2" inf c. → coal; 1½" carb sh, ½" coal, 684'6" 2" dk gy sh; ½" carb sh; ½" coal, Floor: dk. gy. sh.

Overall Recovery 100%

N.S. 147

A%	30·0			
S.G.	1·54			
On comp of floats:*				
M%	2·0			
V.M.%	30·6			
F.C.%	48·9			
A%	18·5			
Joules/gm.	26940			
BTU/lb.	11590			
S%	0·33			
S.G.	1·44	95·8	744/56	550'2¼" Roof: dk gy. sh; 3⅜" inf. coal → coal; 1½" coal → inf. coal; 4¾" coal; 4¾" bluey; 2½" coal w. ¼" m gy. sh. at 1½"; ½" m gy sh.; 1'6" coal → inf. coal in places; ¾" med-dk gy. sh; 10" coal; 4" med gy-br. sh.; 7¾" coal w. ½" sh. lens at 5½"; ½" carb. sh.; 1½" med gy-br sh, 1'9¾" coal; ¾" med. gy. sh.; 10¼" coal (bkn. in btm. 5") 558'2¼" 6" dk gy sh.; 1½" inf. coal; 2¼" carb. sh.; 1¼" coal; Floor: gy. sh.

Overall Recovery 95·8%

N.S. 145

A%	27·1			
S G.	1·52			
On comp of floats:*				
M%	2·2			
V M %	28·2			
F C %	47·6			
A%	22·0			
Joules/gm	25450			
BTU/lb	10950			
S%	0·33			
S G	1·46	82·3	742/56	Roof: 1 gy. f sa.; 3" dk gy sh; 1" fn. sh; 927'10" 6" dk gy sh. & some coal w. fn. sh. lam, 3'0½" (broken) coal; 2" inf. coal; 2½" m gy. sh; 6" (bkn) coal; 1" (b) fn.-med gy. sh; 2'0" (broken) coal; 935'1½" Floor: gy. sh.

Overall Recovery 82·3%

N.S. 148

A%	42·4			
S.G.	1·71			
On comp of floats:*				
M%	2·0			
V.M.%	28·6			
F.C.%	44·3			
A%	25·1			
Joules/gm	24150			
BTU/lb	10390			
S%	0·31			
S G	1·51	95·2	745/56	782'8½" Roof. interbd l gy f sa & dk gy sh, 4½ (p b) coal, ½" m gy sh, ½" carb sh, 2" coal, ½" carb sh; ¼" inf coal, 1½ dk gy sh, 1½" inf. coal → carb sh; 6" carb sh. w coal lents. (slick. 3"-5"), 3½" fn. sh (slickensided), 3½" inf. coal → carb. sh. in places, 2¾" fn. sh, ¾ carb. sh. → inf. coal, 8" (p b) coal; 1½ med gy-fn. sh; 5½ (p b) coal; ¼" carb. sh.; ¼" fn. sh.; 8¼" coal, ¼" carb sh; ½" fn. sh; ¼" carb. sh; 1¾" (p b) coal, 2¾" fn. sh; ½" coal; ⅜" carb sh, 2½" inf. coal, 2½" l gy.-fn. sh; ¾" puggy w/h. sh; ½" carb. sh, ¾" (p b) coal, ½" carb sh; 2" coal, 1¼" carb. sh; ¾" coal, ¼" fn. sh; ¾" carb. sh.; 7" coal w few i. carb. nodules; ¾" m gy. sh; 790'0½" 6½" coal → inf. coal in places; ¼ m gy. sh; ¾" inf. coal; 6½" dk gy sh. → carb. sh. in pl., w. ¾" coal at 4¼"; ¼ coal, 1 med gy. sh.; ¾" inf. coal; 5½" interbd. dk gy. & carb. sh.; Floor: dk gy. sh.

Overall Recovery 95·2%

* For washability tests see Table 1

P.D.T.S. MINE AREAS Nos. 11, 12 & 14 RHONDDA

DIAGRAMS OF STRIPED BACON SEAM — DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 151

Prox. analysis Cal.value, S, SG.		Recovery Section percent	Sampled	Description
A%	33·3			
S.G.	1·58			
On comp of floats:*				
M%	1·9			
V.M.%	29·6			
F.C.%	46·5			
A%	22·0			
Joules/gm	25510			
BTU/lb	10980			
S%	0·31			
S.G	1·47			
		97·3	746/56	669'1" 4½" dk gy. slts.; 8½" wh. f. silic. sa.; 1'3⅝" coal → bluey in places; 1¼" fn. sh.; ½" (o.b.) fn. & carb. sh. lenses; 2" (o.b.) inf. coal; ½" fn. sh.; 2¼" bluey → coal; 3" (o.b.) coal; 1" inf. coal; 1¼" l. gy. sh.; 1'5¼" coal; 1" l. gy. sh.; 5⅛" coal → bluey in btm. ¾"; ½" br. sh.; 3" coal; 1¼" carb. & l. gy. sh. lam.; 2¾" coal; 2⅞" l. gy. sh.; ⅛" inf. coal; ½" coal; ½" carb. sh.; 5⅛" (o.b.) coal; ¾" carb. sh.; ⅛" l. gy. sh.; 1" carb. sh.; 11½" coal w. carb. sh. lam., sh. lents. in btm. 2"; ¼" dk. gy. sh.; 1" coal w. i. carb. nod.; ½" cb. sh.; 676'11" 5¾" coal with carb. sh. lents.; 3½" dk. gy. sh. w. coal & carb. sh. lam. at 1'6"; ¾" inf. coal; 1¼" l. gy. sh.; 11½" dk. gy. sh.
		Overall Recovery 97·3%		

N.S. 154

Prox. analysis Cal.value, S, SG.		Recovery Section percent	Sampled	Description
A%	43·0			
S.G.	1·70			
On comp of floats:*				
M%	1·9			
V.M.%	29·3			
F.C.%	47·1			
A%	21·7			
Joules/gm.	26250			
BTU/lb.	11290			
S%	0·31			
S.G.	1·45			
		95·8	354/57	549'11" Roof: med. gy. sh. → slts.; 1'5" coal (top 1'3" bkn.); 2" carb. sh.; 3'1½" med.-dk. gy. sh.; 1" coal; 3" carb. sh. w. coal lam.; 9" dk. gy. sh.; 556'3½" 3" med. gy. slts.; 1'1" coal; ¾" med. gy. sh.; ¼" carb. sh.; 2¾" coal; 2½" fn. sh.; 3⅝" coal; 4¼" fn. sh.; 1¼" coal; ½" fn. sh.; ¾" carb. sh.; ⅛" fn. & carb. sh. lam.; 6½" coal (bkn. 2⅝"-4½"); 1¼" carb. sh.; 5" coal; ½" carb. sh.; ⅜" dk. gy. sh.; 8" coal (bkn. 2½"-7"); 560'9½" Floor: dk. gy. sh. → carb. sh. in places.
		Overall Recovery 95·2%		

MINE SECTIONS

R/SB 1

				Roof: shale; ¾" bluey; 1" coal; ¾" fn. sh.; 1'11½" coal w. lent. sh. bands, 2⅛" bluey at 6"; ½" med. gy. sh.; 3" coal; 2⅛" bluey; 1" dk. gy. sh.; 5½" coal; 4" coal w. carb. sh. bands; 3" fn. sh. w. ¼" coal at 2¾"; 8" coal w. 1" bluey at 2⅝" & 4⅝" m. gy. sh. at 6"; 3" carb. sh. w. ⅛" fn. sh. at middle; 1'6⅞" coal; ¾" fn. sh.; 3½" inf. coal; 2½" ironstone "boulder"; 2⅛" coal; 2" inf. coal; Floor: 3" (approx.) fn. sh. w. leathery band at base.
				Thickness 7'2¼"

R/SB 2

A%	29·2			
S.G.	1·53			
On comp of floats:*				
M%	2·1			
V.M.%	30·5			
F.C.%	51·4			
A%	16·0			
Joules/gm	27600			
BTU/lb	11870			
S%	0·30			
S.G	1·41			
			1504/58	Roof: l. gy. slts.; 4½" coal; ½" med. gy. sh.; 8" coal → inf. coal in btm. 3"; ½" d. gy. sh.; 1'1" coal; 3" fn. sh. w. ¼" carb. sh. at 2"; 5½" coal; ½" fn. sh.; 3⅝" bluey → coal in btm. 1½"; 1½" fn. sh.; 1" bluey; 1'5½" coal w. ¼" med. gy. sh. at 7"; 1" fn. sh.; 2¼" coal; ½" br. sh.; 3½" coal; 1" fn. sh.; 5" coal, inf. in top 1½"; ¾" med. gy. sh.; 1" coal; 1¾" fn. sh.; 1½" carb. sh.; 4" coal; 3" fn. sh. w. leathery parting at base; Floor: sh.
				Thickness 7'0"

R/SB 3

A%	33·3			
S.G.	1·57			
On comp of floats:*				
M%	2·3			
V.M.%	29·9			
F.C.%	47·0			
A%	20·8			
Joules/gm	25770			
BTU/lb	11084			
S%	0·58			
S.G	1·45			
			1505/58	Roof: dk. gy. sh.; 3½" coal, ½" l. gy. sh.; 1" bluey, 1" coal; 1¾" bluey; 1½" coal; 2⅝" bluey; 3½" coal; 3½" bluey; 3¾" coal w. few carb. sh. lam.; 4⅝" dk. gy. sh. → carb. sh. in btm. 1¾"; 1" fn. sh.; 1¾" carb. sh.; ⅝" d. gy. sh.; ⅝" fn. sh., ½" bluey; ¼" fn. sh., 1¾" bluey w. coal bands; 3' dk. gy. sh. w. l. gy. sh. lenses in btm. 1"; 11¾" coal; ½" med. gy. sh.; 6¾" coal w. penny band at 2"; ½" fn. sh., 2½" coal; ¾" l. gy. sh.; ⅛" carb. sh.; 2" coal; 2⅛" fn. sh.; ⅛" carb. sh.; 3⅛" coal & inf. coal w. penny band at 2"; * 2" coal & inf. coal; 1" bluey; 1" l. gy. sh.; ¾" carb. sh.; 1'8" coal w. inf. bands in top 8"; Floor: carb. sh.
				* Characteristic 3" fn. sh. & basal leathery parting occurs nearby at this point;
				Thickness 7'7½"

R/SB 5

M%	3·7			
V.M.%	22·4			
F.C.%	35·5			
A%	38·4			
Joules/gm	18600			
BTU/lb	8000			
S%	0·38			
S.G.	1·64			
			1013/59	Roof: dk. gy. sh.; 9½" coal; ¼" br. sh.; 1½" inf. coal; 1¼" coal; 5" carb. sh. w. coal lents.; 1½" inf. coal; ½" coal; 3½" carb. sh. & coal lenses; 1" coal & carb. sh. lenses, 2" fn. sh., ¾" carb. sh.; 6½" coal; ¼" med. gy. sh.; 3½" coal w. ½" lent. band l. gy. sh. at 2"; 1¼" l. gy. sh.; 10" coal w. 1½" bluey at 5½"; ¾" fn. sh.; 4⅛" coal; ½" carb. sh., ¼" inf. coal; 1" fn. sh.; 2¾" coal; 1" fn. sh.; 1¾" coal; 1½" fn. sh.; 4" coal (grades to "boulder"); 2¾" coal; 3" fn. sh. w. leathery parting at base.
				Thickness 6'1¾"

* For washability tests see Table I

FIG. 7

P.D.T.S. MINE AREAS Nos. 11, 12 & 14 — RHONDDA

DIAGRAMS OF ROB ROY SEAM — DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 146

Prox. analysis Cal value, S, S.G.	Recovery percent	Section Sampled	Description
		925'6"	1'9" d ← blk sh.; 5½" coal, ½" carb sh; ½" m gy sh arenite; 7½" coal w ½" carb sh at 6", 2¾" carb sh, 7¾" coal ← inf. coal in btm 1¼", ¾" fn sh; 1" carb. sh., 3½" inf. coal, 1" carb. sh., ½" coal, ¼" cb sh, ¾" l gy sh., 2¾" irreg. int bd. cb sh & l gy sh, ½" carb. sh., 1½" coal; 1½" carb. sh, 4" coal; 2¾" carb sh. ← br. sh. at ½"-1¼", ½" br. sh. lens; 1¼" inf. coal ← coal, 1¼" lbr. sh, 4¼" bluey ← carb. sh.; 1½" fn. sh.; 8" carb. sh. w irreg ½" fn. sh lenses, 3" fn sh, ½" carb sh; ½" coal, 1½" carb sh, 2¼" fn-br sh w carb sh lents., 4½" carb sh w ½" inf. coal at 2", 2¼" coal, 2½" fn sh, 3¼" carb. sh, 1½" fn. sh; ¾" inf. coal, 8¾" coal, ¾" m gy sh, 1" coal; 2" inf. coal, 2¾" coal; ½" l-m gy sh; ½" carb. sh.; 2½" coal, 1" inf. coal; 1'3½" coal; 5" carb. sh; 4" coal, 3½" bluey;
		931'2¼"	2¼" coal w i carb nods; ½" carb sh; 1" coal, 10" carb ← blk. sh.

N.S. 151

Prox. analysis Cal value, S, S.G.	Recovery percent	Section Sampled	Description
		701'10"	10" blk sh, 3" coal, ¼" carb. sh; ¼" br sh; ½" coal; ½" carb sh; 2¾" coal w l gy sh & carb. sh. lens at 2"-2¼"; 1¼" l.-m gy. sh; 5¾" coal; 1½" carb sh, 6¾" coal, 3" carb sh; ½" coal, ¾" carb. sh; 1" coal; 1¼" carb sh. w coal lents; 1½" l gy. sh; 1½" blk sh; ½" l gy sh, ½" blk sh; 8" coal; ¾" black-br. sh; 2¼" coal; ¾" l gy. sh; 1¾" coal; ¾" boulder, 1" l gy sh; 3¼" coal w few i. carb nods; 1" carb sh, 2½" coal, inf in btm ½", 1¾" d gy sh; ¾" carb sh, ½" coal.
		706'10"	1' m gy sh, 1" coal; 6" blk & carb sh, w i. carb nods.

MINE SECTIONS

R/RR 1

A%	29·2
S.G.	1·52
On comp of floats *	
M%	2·1
V.M.%	29·7
F.C.%	49·4
A%	18·8
Joules/gm	26720
BTU/lb	11490
S%	0·29
S.G.	1·42

1507/58

3" coal, 1¼" br sh, darker at top; 3½" coal, inf. in btm ½", ¾" br. sh; ¾" bluey; 7½" coal, 1" br sh; 1¼" bluey; 1" inf. coal; 2½" coal w ½" lens m gy sh at mid; ½" br. sh; 4" coal w ¾" lent" bd sh at mid, ½" fn sh, 1¼" bluey; 9¾" coal; ¼" br. sh; 2½" coal inf in btm half, 3½" coal; 1" fn sh, 2" coal & bluey, 1½" fn. sh, 7" coal w few inf. bands; 1" bluey; 1½" inf coal.

Thickness 5'0"

R/RR 2

A%	32·7
S.G.	1·56
On comp of floats: *	
M%	2·1
V.M.%	29·4
F.C.%	48·1
A%	20·4
Joules/gm.	26100
BTU/lb	11230
S%	0·30
S.G.	1·43

1508/58

Roof: d gy. sh, 4" coal w ¾" bluey at 2", 1½" fn sh; 3¾" coal, w penny bd at 1½", ¼" br. sh., 5" coal, inf. at 3½"-4½", ¾" m gy sh, 1¾" bluey, ½" fn. sh; ¾" bluey; ½" l gy sh; 3¾" bluey w. thin coal bands; ¼" coal; ¾" bluey; ½" l gy sh; 2½" bluey w ¼" lent sh. bd at 1½", 1½" coal, 1¼" bluey, 8½" coal, ¾" m gy sh; 1¼" bluey; 2½" coal, inf. in btm ¾", 1" fn sh; 1" coal; ½" m gy sh; 1'2" coal; 1" fn sh, 1¼" inf coal; ¾" d gy sh, 2½" coal; 1" d. gy sh; Floor carb sh.

Thickness 5'9¾"

R/RR 3

A%	41·4
S.G.	1·68
On comp of floats *	
M%	2·0
V.M.%	27·7
F.C.%	47·4
A%	22·9
Joules/gm	24950
BTU/lb	10730
S%	0·28
S.G.	1·47

1502/58

Roof d gy sh, ¾" coal; ½" m gy sh; 1¼" coal, 2¼" bluey; 1½" carb. sh w coal lenses; 1' d gy sh; 10½" coal; inf. at 5"-7"; ¾" carb sh; ½" fn sh; 3½" bluey w penny bds at ½" & 1½", 1½" carb sh; 1" coal; ½" l gy sh"; 2¼" bluey w ½" d gy sh at mid, 6¾" coal w ½" m. gy sh. ¾" fr. btm; 1' br sh; 2" coal; 1' br sh., 2½" coal, inf towards base; 1" bluey, 4½" coal; ½" dk gy sh; 2" inf coal, ½" d gy sh; 1" inf. coal; 4¾" carb. sh w coal lenses. Floor: d gy sh.

Thickness 4'7"

R/RR 4

M%	3·3
V.M.%	22·7
F.C.%	38·6
A%	35·4
Joules/gm	20050
BTU/lb	8620
S%	0·25
S.G.	1·53

1011/59

Roof: d gy sh; 2½" coal, 1" carb. sh, 3¼" coal w. floating penny bd. at 2", 1¼" fn. sh.; 1'0" coal, 2" slightly inf coal, ½" br sh, ¾" carb sh, 2" inf coal, 5" carb. sh. w. coal bands between 2" & 3", 1½" inf. coal; ½" l gy sh, 2¼" bluey, ½" l gy sh, 5½" coal; ½" carb. sh; 5¾" coal, ¼" m. gy sh; 1" inf coal; ¾" fn sh.; 1¼" bluey; 2¾" coal; 2" fn. sh; ½" carb sh, 1" coal; 1¼" bluey ← carb. sh.; 3¼" coal; 1¾" carb sh w ¼" fn sh. bds at top 2" coal; 1" carb. sh w coal lenses; 2" coal; Floor: fn sh.

Thickness 5'8½"

R/RR 5

M%	2·8
V.M.%	25·2
F.C.%	41·4
A%	30·6
Joules/gm	22150
BTU/lb	9530
S%	0·32
S.G.	1·54

1012/59

Roof: d gy-carb sh, 4¾" coal; 1¼" d gy sh; 3" coal; ¾" inf. coal; 1" br. sh; 11½" coal w ½" fn sh at 5½"; 1¾" inf coal; 2" bluey, ½" br sh; 1½" coal, 3½" carb.sh w coal lents, 1½" coal, 3¼" interbd. fn. sh. & carb sh; 1'1" coal; ¾" d gy sh; 5¼" coal, inf. in btm. ¾", ½" fn. sh; 4¾" coal; 1½" carb. sh, w coal lenses; 1" coal; ½" carb sh; 7" coal. Floor: l gy sh;

Thickness 5'10¼"

R/RR 6

1508/58

Roof: med gy sh; 4¾" coal, 1' d. gy sh; 1¾" coal; ¼" fn sh.; 1¾" coal; 1¼" fn sh; 4¾" coal; ½" l gy sh.; 2" bluey; 7½" coal, ½" carb. sh.; ¾" m gy sh; ¾" carb. sh, 1¼" coal; ¼" l gy sh; 2" coal; 1½" inf coal; 2" carb sh. w coal lenses; 2" coal; ½" l gy sh; 1¼" coal; ½" m gy sh.; 1'2" coal; ½" fn. sh.; 1¼" bluey; 5" coal, inf. in btm half; ½" fn. sh.; 10½" coal, w ½" cb sh at 3"; Floor: fn. sh.

Thickness 5'10"

* For washability tests see Table 1

FIG. 8

P.D.T.S. Nos 11.12 & 14 MINE AREAS

RHONDDA

SKELETON PLAN SHOWING

STRUCTURE CONTOURS

STRIPED BACON SEAM

To accompany report by H.R.E. Staines, B.Sc., Geologist

SCALE OF CHAINS

10 0 10

Contours drawn on floor of Seam at 50' intervals
Elevations in feet on State Datum

N.S. 135
R.L. SURF. 117·99
R.L.S.B. −423·70

N.S. 138
R.L. SURF. 156·20
R.L.S.B. −349·80

PROBABLE ZONE OF COMPLEX FAULTING

N.S. 141
R.L. SURF. 106·70
R.L.S.B. −400·85

N.S. 144

N.S. 145
R.L. SURF. 94·20
R.L.S.B. −839·42

RHONDDA FAULT

N.S. 142

N.S. 143
R.L. SURF. 83·15
R.L.S.B. −596·87

N.S. 147
R.L. SURF. 81·25
R.L.S.B. −475·38

N.S. 169

N.S. 166

RHONDDA Rhondda No. 1

N.S. 167

N.S. 164

N.S. 165

N.S. 151
R.L. SURF. 151·20
R.L.S.B. −524·32

N.S. 146
R.L. SURF. 86·65
R.L.S.B. −796·56

N.S. 156

NOBLEVALE No. 1 No. 4 TUNNEL A

N.S. 93

N.S. 155

N.S. 161

N.S. 173
R.L. SURF. 167·07
R.L.S.B. −11·89

N.S. 154
R.L. SURF. 147·50
R.L.S.B. −412·44

N.S. 148
R.L. SURF. 85·06
R.L.S.B. −701·24

SYNCLINAL AXIS

NOBLEVALE No. 1 No. 3 TUNNEL A

N.S. 157

NOBLEVALE FAULT (ASSUMED U.D. POSITION)

N.S. 149
R.L. SURF. 207·50
R.L.S.B. 135 Approx

N.S. 159

N.S. 160

N.S. 150
R.L. SURF. 214·26
R.L.S.B. 149·55

N.S. 163
R.L. SURF. 191·88
R.L.S.B. 39·95

N.S. 92
R.L. SURF. 138·80
R.L.S.B. −316·0

N.S. 89
R.L. SURF. 189·44
R.L.S.B. −617·8

PROBABLE SYNCLINAL AXIS

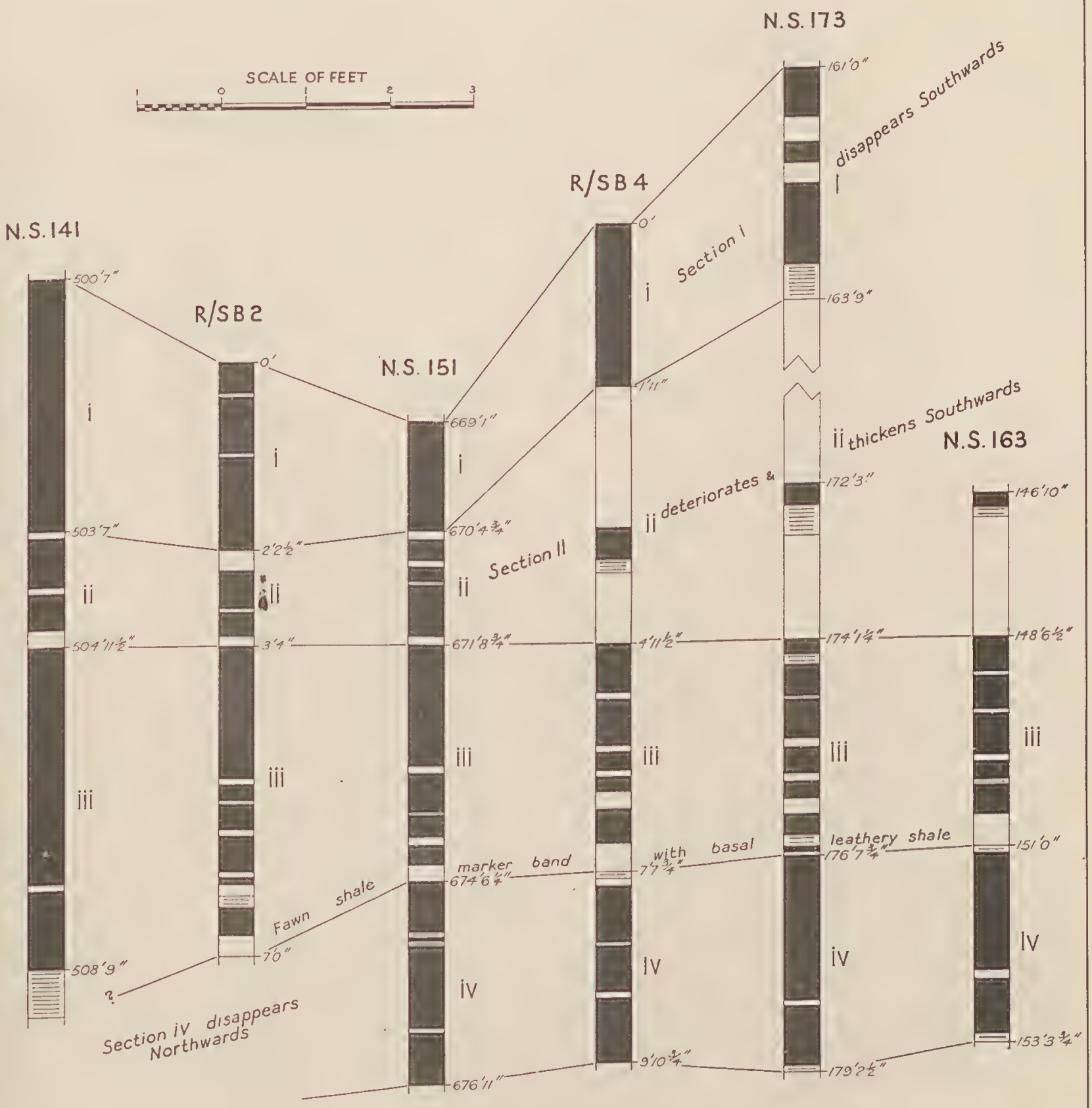
N.S. 152
R.L. SURF. 94·20
R.L.S.B. −759·47

18000N. 16000N. 14000N. 12000N. 10000N. 8000N.

10000E. 12000E. 14000E. 16000E. 18000E. 20000E. 22000E. 24000E.

FIG. 9

P.D.T.S. MINE AREAS Nos. 11, 12 & 14 RHONDDA
CORRELATION DIAGRAM STRIPED BACON SEAM



QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 299

OCCURRENCE OF PETROLEUM AND NATURAL GAS IN QUEENSLAND

Compiled at the Geological Survey of Queensland

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PREFACE

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In the October 1952 number of the Queensland Government Mining Journal there appeared a paper by W. D. Mott, Senior Geologist, Geological Survey of Queensland, entitled "Oil in Queensland." This paper covered the stratigraphy and structure of the possibly oil-bearing sedimentary basins, gave an outline of the history of the petroleum search in this State, and presented a summary of the known occurrences of petroleum. The paper concluded with a discussion on the State's petroleum potentialities.

Mr. Mott's original paper included detailed accounts of all wells drilled primarily for oil or gas, as well as tabulated data on oil, gas and water analyses, which from various considerations were not published.

In the present report the original published material has been revised and brought up to date and the detail that was omitted from the earlier paper has been included. An exhaustive bibliography has been added.

The revision and additional material are the work of Messrs. J. H. Brooks, T. J. Madden and R. J. Allen.

The present paper brings the history of the oil search up to date as at the end of December, 1959.

A. K. DENMEAD,
Chief Government Geologist.

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OCCURRENCE OF PETROLEUM AND NATURAL GAS IN QUEENSLAND

PART 1

INTRODUCTION

Numerous reports of traces of wax, oil and gas from bores are on record, many of which have been officially discounted, some confirmed by Government Chemical Laboratory analysis and others not investigated officially. Most of the occurrences are in insignificant quantity from a commercial point of view. Such occurrences are not claimed to be indications of near-by commercial accumulation, but it is suggested that they prove the wide-spread existence of sediments capable of generating petroleum.

A large area of Queensland is covered by Cretaceous and younger sediments; in this area correlation of buried rocks has to be based very largely on artesian bore records which usually take the form of drillers' logs. Scarcity of fossil evidence leaves only lithology and aquifers on which to base the correlations, and as most water bore logs are not detailed, the interpretation is of necessity somewhat conjectural.

Sedimentary rocks occupy an area in excess of 450,000 square miles in Queensland. Of over 12,000 water bores drilled in this area more than half are less than a thousand feet deep. The deep bores are usually many miles apart even in the more closely drilled areas, and, except in areas of shallow basement, very few have completely penetrated the sedimentary cover.

Sixteen figures accompany this paper. Figure 1 shows the distribution of all natural gas and petroleum occurrences verified by chemical analysis and the location of some reported occurrences which are considered important. The locations of all wells drilled specifically to search for oil and gas are shown. Figure 2 shows the geological elements of Queensland. Figure 3 shows a series of E-W sections through the Great Artesian Basin. The remaining figures are generalised stratigraphic logs of the more recent wells.

Lists of gas, oil and water analyses and a complete bibliography, are included.

HISTORY

During the early days of settlement in inland Queensland, bores drilled for water occasionally produced traces of oil and gas, but it was not until gas in quantity was found at Roma that the search for oil began.

In 1897 a town-water bore was drilled on Hospital Hill about a mile to the west of Roma. Later, in 1899, the water supply having proved inadequate, a further bore, Queensland Government No. 2, was drilled close by to determine the water-bearing potentialities of the sediments below the main aquifer. During the drilling operations a flow of gas was struck at 3,683 ft. which was measured at 44,600 cu. ft. per day. The

Aerial view of Hospital, Hill, Roma, showing:—(1) Site of the old Government Bore, and (2) A.A.O. No. 4.

gas was not utilised and apparently ran to waste. Subsequently, in 1904, the flow was again measured, this time at 72,000 cu. ft. per day. In 1906 a gasometer was erected and it was planned to harness the gas flow to provide lighting for the town. However, after 10 days the flow of gas stopped suddenly and subsequent examination of the borehole with plummets indicated a blockage at 3,282 ft. After this the scheme for lighting the town was abandoned.

The Roma Mineral Oil Co. was formed in 1907 and with a State Government subsidy a well, Q.G. No. 3, was drilled for oil on Hospital Hill, 250 ft. from the water bore. Gas was struck at 3,702 ft., in a much greater volume than in Q.G. No. 2. Before the flow could be controlled, the gas was ignited by the fire from the steam plant and 6 weeks elapsed before the blaze was extinguished. Gas still continued to flow in undiminished volume after the fire, the pressure being such that it was impossible to get the tools into the hole to resume drilling. The hole was capped and left for three days; when the hole was opened there was no flow of gas. Drilling was continued for 10 ft., then the tools became stuck and were lost. In the subsequent fishing operations, two more sets of tools were lost in the hole and finally the well was abandoned.

At this stage the Queensland State Government consulted a number of petroleum technologists from Great Britain and the United States to determine the future programme in the Roma district. In the light of the knowledge at that time it was assumed that a very thick sedimentary section was present at Roma. Bores had penetrated marine Cretaceous and fresh-water Jurassic sediments to 3,700 ft. without any indication of basement, and there seemed every reason to suppose that a thick sequence of Triassic, and Permo-Carboniferous marine rocks, such as crop out to the north of Roma, existed under the area.

After careful consideration of the consultants' advice, the State Government decided to drill further deep bores. The area around Roma was proclaimed an oil reserve, and a site for No. 4 well was selected on Hospital Hill 400 ft. from No. 3 well. Drilling began in January 1916, and by the end of the year had reached 1,700 ft. At the end of 1917 the depth of the well was 2,875 ft. Drilling was suspended during 1918, and in 1919 the well was deepened to the gas horizon. There was a slight showing of gas between 3,610 ft. and 3,703 ft. but this was not fully tested for fear of collapse of the hole. At 3,702 ft. the drill stem broke and the tools were lost in the hole. In 1920 the casing was cut above the lost tools at 3,624 ft. and while the casing was being pulled, a large flow of gas broke into the well, seemingly from below. The extractable gasoline content of the gas was found to be 1·22 pints per 1,000 cu. ft. During 1921 an attempt was made to side-track the old hole and drill ahead, but during these operations the gas flow failed and attempts to revive it were unsuccessful. In 1922 work was continued and the hole side-tracked, but difficulties in controlling the flow of water finally resulted in the abandonment of the well.

In 1920 a committee had been appointed to study the position at Roma. In the report of February 1921, two noteworthy points were brought out:

(i.) "Apart from the petrol absorbed from the gas no liquid oil has yet been noticed in any material yielded from this (No. 4) bore.

(ii.) While natural gas fields result from petroleum deposits some gas fields are known which do not yield any oil. Other natural gas fields yield oil only in small quantities and over small areas of the gas field. The finding of a natural gas containing petrol of the composition found at Roma is looked on as a very strong indication of the close proximity of oil. It is not, however, proof of such proximity and is certainly no proof of the presence of oil in commercially payable quantities. The most that can be said is that the fact that the gas contains petrol materially increases the prospects of success in boring for it."

The soundness of this latter statement has been fully justified by subsequent drilling and, even with the knowledge gained since that time, it could hardly be bettered today.

Despite the oil reserve placed around Roma, one company, Lander Oilfields (Australia) Ltd., was granted a permit to drill near Orallo, 25 miles north-west of Roma. During the period 1923 to 1926, this company drilled three holes, the deepest of which (No. 3) bottomed in granite at 2,660 ft. Later in 1926 the No. 1 well was deepened and also struck granite at 2,631 ft. Showings of oil and gas were logged in these wells and it was reported that an "oil sand" was penetrated, but nevertheless the wells were abandoned.

The presence of basement at so shallow a depth completely altered the concept of the geology of the district and necessitated a revision of the existing ideas on the potentialities of the region.

In 1924-25 Dr. A. Wade, adviser on petroleum to the Commonwealth, spent three months investigating the State's petroleum possibilities, visiting the Beaudesert-Boonah, Tewantin, Wolston, Longreach and Miles-Roma-Injune areas. Of these areas, Dr. Wade considered the Miles-Roma-Injune to be the only one worthy of further attention. On the evidence before him he estimated the chances of obtaining oil in this area at 30 per cent.

In 1926 the State Government withdrew the reservation placed on the Roma district. A new company, the Roma Oil Corporation, took over the plant and operations of Lander Oilfields (Australia) Ltd., and its first well, R.O.C. No. 1 (Hospital Hill), was spudded in close to the old Roma Mineral Oil

Company's No. 1 well on Hospital Hill. In selecting the location for this well, L. C. Ball of the Queensland Geological Survey obtained, from pits, dip evidence which he considered indicated that Hospital Hill coincided with a gentle structural dome. In 1927 a large flow of gas was struck at 3,703 ft., and flowed under control at 350 p.s.i. Light oil condensed at the mouth of the blow-off pipe and the petrol content of the gas was measured at 2·6 pints per 1,000 cu. ft. On deepening the well, production of gas was increased to 1,250,000 cu. ft. per day. At 3,869 ft. the drill passed out of the gas sand into metamorphosed rocks with quartz veins, which evidently represented basement. In 1928 an absorption plant was erected to recover the gasoline content of the gas and the liquid was sold directly as a motor spirit from a pump. Efforts to revive the gas flow after silting and to shut off water from the hole, were unsuccessful, and the well was abandoned in 1930.

The partial success of this well produced a minor oil boom and all the country around Roma was taken up in permits and leases. During 1928 seven deep tests were begun. Roma Oil Corporation began a second well (R.O.C. No. 2) on Hospital Hill; this encountered bedrock at 3,955 ft., apparently without striking any appreciable gas flow. The well was taken to 4,005 ft., the last core consisting of quartz-veined, crushed and foliated metamorphosed shale and grit. Another well, Lander Oilfields (Australia) Ltd. No. 4, drilled on the south flank of Hospital Hill, produced a small quantity of gas, which was reported to be more highly petroliferous than that in R.O.C. No. 1. This well bottomed at 4,109 ft. in metamorphosed shale and grit.

In 1929, 20 deep tests were drilling in the Roma district, but towards the end of the year activity declined as more and more dry holes were completed. Numerous shows of oil and gas were obtained from many of the wells, but in only one well, drilled by the Roma Blocks Oil Co. near Mt. Bassett, 7 miles north-east of Roma, was the showing appreciable. An "oil-sand" yielding 10 gallons of oil per day, but no gas, was reported at 3,445 ft. to 3,447 ft. (total depth).

Before the end of 1930, the centre of activity had moved to Blythdale, 10 miles east of Roma. Here five wells were drilled by different companies on what was believed to be a dome structure in Mesozoic rocks. The deepest well bottomed in granite at 4,130 ft. Good showings of oil were obtained in arkosic grits slightly above basement but in most cases the artesian water could not be shut off from the wells. Production was in too small a quantity to be payable and the area was abandoned.

Early in 1931 gas was again produced from R.O.C. No. 1, at the rate of 500,000 cu. ft. per day. The gas was run through the absorption plant for three months. Later R.O.C. No. 3 was brought in, and the combined production was put through the plant. The 27,000,000 cu. ft. of gas produced yielded 4,797 gallons of natural gasoline. These operations ceased towards the end of the year when diminishing production made the project uneconomical. Up to this point in the search for oil the sum total of all production had been 30,000 gallons of natural gasoline from the wells on Hospital Hill and several hundred gallons of oil from the wells at Blythdale and near Mt. Bassett. A quantity of oily wax had been collected from the Town Water Bore at Longreach.

In 1930, Oil Search Ltd. began operations, with geological surveys in the Roma district and scout drilling near Warooby. Some 43 bores, drilled to an average depth of 160 ft., confirmed a structure indicated by earlier scout drilling by Builders Ltd.

In March, 1934, Drillers Ltd., an associate of Oil Search Ltd., began drilling O.S.L. No. 1 (Warooby), 6 miles east of Roma. The well bottomed in granite at 3,794 ft. Wet gas was produced at the rate of 500,000 cu. ft. per day but the well was closed down after testing in 1935. In March, 1952, the well blew out and was sealed in June, 1952.

In July, 1934, the Government again proclaimed an oil reserve in a rectangular area of 40,000 sq. miles around Roma; the legislation governing the search for oil in Queensland was amended and made more stringent, to prevent operations by speculative concerns with insufficient financial backing. In September, 1934, Oil Search Ltd. was granted an Authority to Prospect within the proclaimed area. Engaging the services of Dr. F. Reeves and D. Condit, it began regional geological surveys over an area extending from Roma to Springsure. Several good structures were found in the area and two sites were selected for testing. These were near Hutton Creek, approximately 60 miles north of Roma, and on Arcadia Station, 20 miles further to the north.

O.S.L. No. 2 (Hutton Creek) began drilling with cable tool plant in October, 1935, and by June, 1936, had reached 3,715 ft. At this depth, it was considered unsafe to continue drilling with this equipment and operations were temporarily suspended. Drilling of the Arcadia structure began in August 1936, and reached the limit of the plant at 4,110 ft. in December, 1937. By this time the Commonwealth Government was assisting the company financially to enable it to continue operations. At the beginning of 1938, drilling at O.S.L. No. 2 (Hutton Creek) was resumed, using rotary plant on loan to the company from the Government. The well was deepened to 4,688 ft. and at this depth was abandoned as a dry hole.

The rotary plant was transferred to O.S.L. No. 3 (Arcadia) and the well was deepened to 6,025 ft. Showings of oil and gas were obtained from several depths and very considerable flows of wet gas were recorded from three different sands between 2,500 ft. and 2,700 ft. These shows were very significant as this was the first time that oil indications had been found in rocks older than those present in the Roma district. Here the rocks were of Permian age, the gas being found some thousands of feet above basement, suggesting the possibility that the Roma shows might be due to the migration of the gas from Permian

deposits elsewhere, or, at the very least, that the gas deposits were not confined to the lower beds of the Mesozoic sequence as found at Roma.

The lowest of the gas sands encountered—between 2,671 ft. and 2,697 ft.—had the largest flow of gas, measured at between 3,000,000 and 4,000,000 cu. ft. per day at a pressure of nearly 500 p.s.i. Six months later when measured with new equipment, the gas flow was found to be 2,418,000 cu. ft. at 455 p.s.i. pressure. At the time, the utilisation of this gas was considered, but Oil Search Ltd. decided to concentrate the search for oil in Papua and New Guinea and surrendered its Queensland holdings.

During the preceding 35 years the search for oil had been centred mainly around Roma but some drilling had been done in the Beaudesert and Longreach areas. In 1922 oil indications were reported from a bore near Beaudesert and several years later Beaudesert Boring Co. No. 1 was put down and abandoned in coal measures at 1,437 ft. as a dry hole.

In the town of Longreach the water from the Town Water Bore No. 2 had been bringing up blobs of paraffin wax for many years. In 1928 Longreach Oil Wells Ltd. drilled a well close to the water bore. The well, which bottomed in granite at 3,298 ft., penetrated between 3,227-3,230 ft. an horizon which yielded wax at the rate of two gallons per day. Later in 1932, Oil Search Ltd. carried out scout drilling near Longreach, and large parts of the area were photographed from the air. By 1934 all activity in the area had ceased.

Between 1930 and 1934 a well was drilled at Wellington Point near Brisbane to test reported oil shows found in a water bore nearby. The well bottomed in metamorphic rocks at 3,950 ft. Gas and oil films were recorded from various horizons but in no significant quantities and the well was abandoned.

In October, 1935, Murilla Oil Co. began drilling with percussion tools, 4 miles west of Miles.

In November, 1939, the Queensland Government further amended that part of the Mining Act pertaining to the search for oil. The main feature of the amendments was a substantial increase in the size of the area granted for general investigation, and prospecting permits for areas of 200 square miles in which drilling could be done.

Encouraged by this new legislation the Shell Company applied for and was granted an Authority to Prospect covering 136,000 sq. miles. A subsidiary, Shell (Queensland) Development Pty. Ltd., was formed, and exploration work began in May, 1940. Reconnaissance surveys were made over the area covered by the Authority with investigations sometimes extending outside these limits; gravity surveys were also made and air photographs were taken of much of the area. By 1942 several structures had been located between Roma and Springsure and Petroleum Prospecting Permits were taken out to cover these areas. However, due to war conditions and the unavailability of drilling equipment, operations were suspended in 1943. When work was resumed in 1947, structure core-drilling was carried out over these structures in an effort to locate a culmination suitable for drilling. Finally the Morella structure was selected, and drilling began in April, 1950. The well was abandoned as a dry hole at 4,634 ft. in February, 1951. Further drilling was contemplated on the Comet Anticline but the project was abandoned after a seismic traverse across the structure had indicated basement at a shallow depth. The company relinquished its permits and withdrew from the search in April, 1951.

In August, 1948, Condamine Oil Ltd. began drilling with percussion tools at Speculation, 24 miles north-east of Chinchilla.

In 1952 Associated Australian Oilfields N.L. entered the field and began drilling A.A.O. No. 1, between Roma and Warooby, to test a structure indicated as a gravity high by a Bureau of Mineral Resources gravity meter survey made during 1947-48, and supported by a seismic survey by the Bureau in 1950 on behalf of Roma Blocks Oil Co. N.L. and other associated companies. Basement was met at 3,879 ft. and small gas shows were recorded at 3,713 and 3,750 ft. The well was abandoned in August, 1952. Two further wells had been drilled by the end of 1953, both being abandoned as dry holes.

Early in 1953 an Authority to Prospect covering 5,700 square miles of the Maryborough Basin was taken out by the Lucky Strike Drilling Co., of Texas, U.S.A. This was the first time that attention had been directed to this part of Queensland, except for several very shallow bores which were drilled near Bundaberg in 1923.

The discovery of oil in commercial quantities at Rough Range in Western Australia in December, 1953 led to an intensification of the search for oil in Queensland. Many new companies were formed and large areas of the State were taken up under oil prospecting titles. By December, 1954, Authorities to Prospect covering 340,000 square miles, had been granted to fourteen different companies.

During 1954 and 1955 eighteen wells and twenty-four scout bores were drilled or drilling in Queensland. In the Longreach area four wells were drilled to basement to investigate the showings of wax which had been obtained in L.O.W. No. 1. One hundred and ten miles south-west of Longreach, the Westland Oil Co. drilled three wells, two of which penetrated to basement, to test the reported occurrence of wax in water bores in the district. The Lucky Strike Drilling Co. drilled two wells in the Maryborough Basin, on structures in Cretaceous sediments. In the Roma area, Associated Australian Oilfields N.L. drilled three more wells; only one, A.A.O. No. 4 (Hospital Hill) gave any significant showings of gas. Australasian Oil Exploration Ltd. drilled two wells on Reid's Dome and one on the Consuelo Anticline; these structures are located in Permian strata approximately 50 miles south-east of Springsure. Winneills

Pty. Ltd. drilled a well at Wellington Point near Brisbane, and several shallow scout bores for gas in the Mount Walker district, 20 miles south-west of Ipswich.

Numerous small showings of oil and gas were obtained from these wells, but only two were noteworthy. A.A.O. No. 4 (Hospital Hill) struck gas at 3,700-3,716 ft., which on testing recorded a maximum flow of 870,000 cu. ft. per day through a ⅜-in. bottom hole choke. However, in view of the number of wells that had produced gas from Hospital Hill previous to this, the occurrence did not add much to the existing knowledge. In the A.O.E. No. 1 well, on Reid's Dome, dry gas was struck at 466 ft., and flowed at the rate of 550,000 cu. ft. per day.

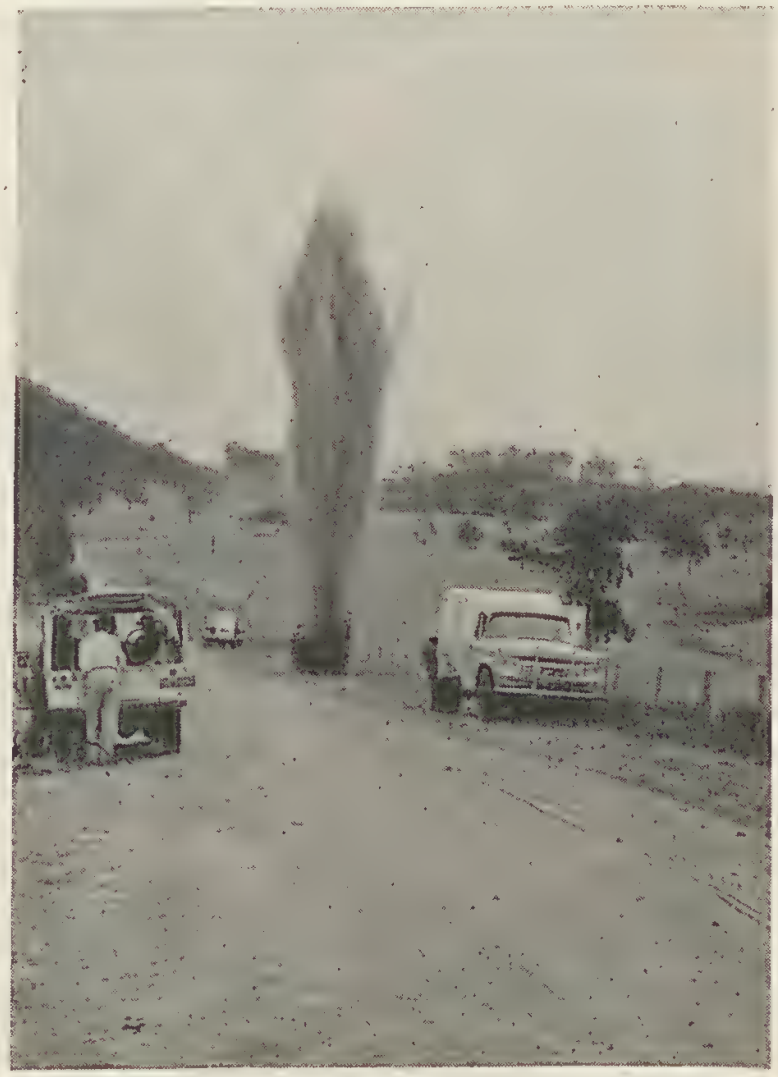
There was little drilling in 1956. Murilla Oil Ltd. No. 1 (Boyanda) which had been drilling since 1935, was abandoned as a dry hole at 4,782 ft. Mackay Oil Prospecting Syndicate began drilling a deep scout bore (No. 5) at Cape Hillsborough. Shallow scout bores were drilled near Mackay (Mackay Oil Prospecting Syndicate), Mt. Walker and Bald Hills (Winneills Pty. Ltd.) and Twin Hills (Providence Oil Pty. Ltd.)

In 1957, five wells and four scout bores were drilling or drilled. A.A.O. No. 7 well was drilled at Arcadia, via Injune, to 3,280 ft. South Pacific Ltd. drilled S.P.L. No. 1 at Birkhead, via Tambo, to 5,185½ ft. Zinc Corporation Ltd. drilled Z.C.L. No. 1 at Weipa in western Cape York Peninsula, to 3,243 ft. Frome-Broken Hill Co. Pty. Ltd., Associated Australian Oilfields N.L. and Associated Freney Oil Fields N.L., in a joint venture, drilled F.B.H. No. 1 at Wyaaba, via Normanton, to 2,822 ft. All of these wells were abandoned as dry holes. M.O.P.S. Scout Bore No. 5 (Cape Hillsborough) was abandoned as a dry hole at 2,440 ft. Other scout bores were drilled at Talbalba, via Cunnamulla (Australian Oil and Gas Corporation Ltd.), Ray, via Quilpie (L. H. Smart Oil Exploration Pty. Ltd.) and Cribb Island, near Brisbane (Standard Gas Pty. Ltd.).

In 1958, three wells and nine scout bores were drilled or drilling. Associated Australian Oilfields N.L. drilled A.A.O. No. 8 at Karumba, via Normanton, to a final depth of 2,364 ft. Drilling of C.O.L. No. 1 (Speculation) was suspended to allow change over from percussion to rotary equipment. Longreach Oil Ltd. drilled L.O.L. No. 5 at Balmoral, near Longreach, to a final depth of 1,367 ft. Scout bores were drilled at Canaway Downs, via Quilpie (L. H. Smart Oil Exploration Co. Ltd.), Cribb Island, Pinkenba and Gumdale (Standard Gas Pty. Ltd.) and Plevna, via Mackay (W. C. and H. J. Walz). Publication of the discovery, in the middle of Great Artesian Basin, of large domal structures, awoke much interest in the oil possibilities of Queensland. By the end of 1958, nearly the whole of the State had been taken up under oil prospecting titles.

In 1959, five wells and twenty-eight scout bores were drilled or drilling in Queensland, and one deep

Geophysicist of Mines Administration Pty. Ltd. operating Worden gravity meter.



Reflection seismic shooting by Geosurveys of Australia Ltd. near Beaudesert, S.E. Queensland.

well (D.F.S. Innamincka No. 1) was drilled in South Australia, adjacent to the Queensland border. Australian Oil and Gas Corp. Ltd. deepened an artesian water bore at Mirri Mirri, via Meandarra, for stratigraphic information. Humber Barrier Reef Oils Pty. Ltd. drilled a stratigraphic well (H.B.R. No. 1) to final depth of 1,898 ft. on Wreck Island, off Gladstone. Longreach Oil Ltd. drilled L.O.L. No. 6 to final depth of 1,268 ft. at Balmoral. Associated Freney Oil Fields N.L. began drilling near Cooroorah in October; progress depth on 31st December, 1959, was 2,822 ft. Delhi Australian Petroleum Ltd., Frome-Broken Hill Pty. Ltd. and Santos Ltd. began drilling a well near Betoota; progress depth on 31st December, 1959, was 1,701 ft. Condamine Oil Ltd. continued washover and milling operations in C.O.L. No. 1 (Speculation). Scout bores were drilled at Canaway Downs and Gumbla (L. H. Smart Oil Exploration Co. Ltd.), Gumdale and Cribb Island (Standard Gas Pty. Ltd.), Burketown and Mornington Island (Santos Ltd. and Delhi Australian Petroleum Ltd.).

SEDIMENTARY BASINS

Sedimentary basins occupy most of the area of the State. They include the Georgina, Hodgkinson, Star, Drummond, Yarrol, Bowen, Great Artesian, Esk, Maryborough, Moreton and Laura Basins.

Georgina Basin

The name Georgina Basin is used in a loose sense, to indicate the area south and west of the Cloncurry Massif, in which Lower Cambrian to Lower Ordovician marine sediments crop out.

Hodgkinson, Star and Drummond Basins

These are three Middle Palaeozoic basins in north-eastern and central Queensland. Sedimentation began in upper Middle Devonian times and continued into the Lower Carboniferous (except possibly in the Hodgkinson Basin, where proof is lacking). The Hodgkinson Basin contains marine and continental sediments, including conglomerate, greywacke, sandstone and shale, with some limestone. These sediments have been strongly folded, intruded by granite, and mineralised. In the Star Basin, the succession is probably paralic. It generally begins with a thick coralline limestone of upper Middle Devonian age; this is followed by conglomerate, sandstone and shale, with plant beds. In the Drummond Basin, the succession consists of mainly continental conglomerate, sandstone, shale and possibly volcanics; marine beds crop out in the north-east.

Yarrol Basin

The Yarrol Basin extends from Broad Sound through Rockhampton and Yarrol to south of Mundubbera, where it disappears under the Great Artesian Basin, to reappear near Texas on the New South Wales border. It originated as an intra-montane marine basin, at the same time as the Drummond Basin, i.e. at the beginning of the upper Middle Devonian. Sedimentation continued into the Permian. The strata include andesite, andesitic tuff, shale, grit, sandstone and limestone.

Bowen Basin

The Bowen Basin began as a great miogeosyncline in the early Permo-Carboniferous. In the north, the sequence consists of thick continental volcanics, followed by marine beds with intercalated coal measures, followed by thick Permian coal measures. The Bowen Basin plunges southward under the Great Artesian Basin. The Springsure Shelf extends westward from the Bowen Basin into the eastern part of the old Drummond Basin. The Triassic sediments of the Bowen Basin are continental shale and sandstone, continuous to the south with the Triassic sediments of the Great Artesian Basin. Downwarping of the Bowen Basin had ceased by the Jurassic.

Great Artesian Basin

The Great Artesian Basin is the largest artesian basin in the world, covering a known land area of 670,000 sq. miles, of which an area of some 430,000 sq. miles lies in Queensland. Subsidence began in the Permian, and may still be in progress. The Great Artesian Basin is divided into three lesser basins: the Carpentaria, Eromanga and Surat Sub-Basins, by two main ridges of bedrock: the Euroka and Nebine Ridges.

Sedimentation began in late Permian times in the area south-west of the Bowen Basin, and continued into the Triassic. In the Upper Triassic, a freshwater transgression greatly extended the limits of the basin. In the Lower Cretaceous, a marine transgression extended the limits of the basin to their maximum. In the Upper Cretaceous, there was a return to continental sedimentation.

Large folds exist in the deeper part of the basin, in the south-western part of the State. The fold axes generally trend north-east; the larger structures are up to 50 miles in length; closure at surface is up to 1,000 ft.

Esk Basin

The Esk Basin may have formed as a rift at the beginning of Permo-Carboniferous times. The succession includes Permo-Carboniferous marine sediments, and Triassic continental andesitic agglomerate and tuff, conglomerate, sandstone, shale and acid volcanics. Sedimentation ceased in the Upper Triassic.

Maryborough Basin

The Maryborough Basin began to subside in the late Palaeozoic. Sedimentation was marine in the Permo-Carboniferous, continental from Triassic to early Cretaceous, marine in the Aptian, and continental again in the Upper Cretaceous.

Moreton Basin

The Moreton Basin probably began to downwarp in early Triassic times. Basic volcanic flows and tuff

are overlain by Middle Triassic breccia, shale, conglomerate, tuff, sandstone and coal measures, Upper Triassic sandstone, and Jurassic sandstone and coal measures. Sedimentation ceased in the Jurassic.

Laura Basin

Subsidence of the Laura Basin possibly began early in the Jurassic. Sedimentation appears to have been continental until the Aptian, when there was a marine incursion.

Tasman Geosyncline

The Tasman Geosyncline was a great mobile belt, which throughout the Palaeozoic, occupied what is now the eastern coastal portion of Australia. The Queensland portion included the Hodgkinson, Star, Drummond, Yarrol, Bowen, Esk and Maryborough Basins.

STRATIGRAPHY

Precambrian

Precambrian rocks crop out mainly in the Cloncurry, Georgetown and Cape York Peninsula areas. They range from high-grade metamorphics (Archaeozoic?) to unaltered sediments (Upper Proterozoic?).

Certain unfossiliferous low-grade metamorphics in the structural highs of the Tasman Geosyncline may also be of Precambrian age.

Cambrian-Ordovician

Fossiliferous Cambrian and Ordovician strata crop out only in the Georgina Basin. They consist mainly of marine limestone, dolomite, sandstone and siltstone, and range from Lower Cambrian to Middle Ordovician in age. In part, they are richly fossiliferous. These Cambrian-Ordovician beds generally lie sub-horizontally and are unmetamorphosed. They are potential source beds for petroleum.

Some of the apparently unfossiliferous low-grade metamorphics cropping out in the structural highs of the Tasman Geosyncline may belong to the Cambrian and Ordovician.

Silurian

Silurian rocks crop out only in the eastern part of the State, within the area of the Tasman Geosyncline. In the Upper Silurian-Lower Devonian, 20,000 ft. of limestone, shale, sandstone and conglomerate were laid down on the Chillagoe Shelf. In part, the limestone is abundantly fossiliferous, and appears originally to have been biohermal. The strata are strongly folded and slightly metamorphosed.

Some of the apparently unfossiliferous low-grade metamorphics of the structural highs of the Tasman Geosyncline may belong to the Silurian.

Devonian

Devonian strata, like the Silurian, crop out only in the eastern part of the State. The thick limestone, shale, sandstone and conglomerate strata of the Chillagoe Shelf extend up into the Devonian. In the coastal highs, Lower or lower Middle Devonian andesitic tuff and limestone appear to lie conformably on Silurian(?) quartzite. Upper Middle Devonian and Upper Devonian limestone, tuff, sandstone, conglomerate and shale are found only in the Drummond, Star, Hodgkinson and Yarrol Basins; only in the Yarrol Basin are these sediments entirely marine.

Probable mid-Devonian serpentines are associated with epi-lower Middle Devonian earth movements.

Lower Carboniferous

Lower Carboniferous strata lie conformably on the Upper Devonian in the Drummond, Star, Hodgkinson and Yarrol Basins; they are mainly continental in the Drummond, Star and Hodgkinson Basins, and marine in the Yarrol Basin.

Middle Carboniferous (Moscovian) marine beds crop out in the Yarrol Basin and near Mt. Barney in the far south-east of the State.

Permo-Carboniferous

This term is used because of doubt about how much of the strata are Upper Carboniferous and how much Permian in age.

In the Bowen Basin, the Bowen System consists of volcanic rocks, and marine and continental sediments. The distribution of the various lithofacies is fairly well-marked, with continental sediments to the north and west, marine sediments to the south and east, and both marine and continental sediments between these areas. The marine sediments are essentially miogeosynclinal.

The Lower Bowen consists mainly of volcanics, which range from basalt through andesite to rhyolite, but also contains continental and marine sediments; the thickness is about 5,000 ft. The Middle Bowen consists of about 3,500 ft. of continental and marine sediments; at the base are the Collinsville Coal Measures, overlain by predominantly marine sediments. The Upper Bowen consists essentially of continental beds with coal seams, and is about 10,000 ft. thick.

In the Styx River area, the Bowen sequence is considerably thicker than in the Bowen Basin proper.

On the Springsure Shelf, the Bowen sequence consists of continental glacials, overlain by sandstone and shale, with a single, short, narrow marine incursion from the Bowen Basin.

In the Great Artesian Basin, Permo-Carboniferous sediments have been met in bores at Wallumbilla and Innamincka (in north-eastern South Australia), and possibly at Springleigh, Hughenden and Burketown.

In the Yarrol Basin, sandstone and limestone are followed by volcanics. In the Esk Basin, thick volcanics and some thin marine strata occur. In the Gympie area the strata consist of greenstone, shale, greywacke, conglomerate and limestone.

Epi-Permian granites intrude the coastal ranges.

Triassic

The Triassic strata crop out only in the south-eastern part of the State, but have been met in bores over much of the Great Artesian Basin. They are entirely continental, and include shale, sandstone, conglomerate and volcanics.

In the southern part of the Bowen Basin, and in that part of the Great Artesian Basin south of the Springsure Shelf, the older Triassic sequence rests with slight unconformity on the Permo-Carboniferous, and consists of quartz sandstone (Clematis Sandstone), 400 ft. thick, followed conformably by shale and sandy shale (Moolayember Shale) over 1,000 ft. thick. These older Triassic beds are overlain unconformably by Upper Triassic quartz sandstone and shale (equated with the Bundamba Group of the Moreton Basin), about 800 ft. thick. These beds are widespread in the Eromanga and Surat Sub-Basins, and contain the principal aquifer.

In the Moreton Basin, Middle Triassic coal measures (Ipswich Coal Measures), 4,000 ft. thick, are overlain unconformably by Upper Triassic continental sandstone and conglomerate (Bundamba Group), 750 ft. thick. In the Esk Basin, Lower and Middle Triassic volcanics, shale, sandstone and conglomerate are overlain unconformably by sandstone equated with the Bundamba Group. In the Maryborough Basin, Middle Triassic shale, sandstone and conglomerate are overlain by sandstone equated with the Bundamba Group.

Jurassic

Jurassic sediments crop out only in the eastern part of the State, but like those of the Upper Triassic, have been met in bores over much of the Great Artesian Basin. They are entirely continental.

In the Great Artesian Basin, the Upper Triassic beds are overlain conformably by up to 1,000 ft. of continental sandstone, silt and shale (equated with the Marburg Sandstone of the Moreton Basin). These beds are followed conformably by up to 1,350 ft. of continental calcareous shale, sandy limestone and coal measures (equated with the Walloon Coal Measures of the Moreton Basin). In the Carpentaria Sub-Basin possible Jurassic sandstone crops out near Croydon, and was met in Zinc Corporation Ltd. No. 1 (Weipa) well.

In the Moreton Basin, continental feldspathic quartz sandstone, silt and shale (Marburg Formation) overlie the Bundamba Group conformably, and are overlain conformably by continental shale, sandstone and coal measures (Walloon Coal Measures).

In the Maryborough Basin, coal measures equated with the Walloon are intruded by porphyrite and andesite.

In the Laura Basin, sandstone, conglomerate and shale with thin coal bands, are referred to the Jurassic.

Cretaceous

Cretaceous strata, both continental and marine, are very widespread in Queensland.

In the Great Artesian Basin, Upper Jurassic-Lower Cretaceous sandstone, shale and conglomerate (Blythesdale Group), up to 1,200 ft. thick, lie conformably on Jurassic or unconformably on older strata. They are continental in the lower half, and transitional to marine in the upper half. They are followed conformably by about 1,200 ft. of marine Lower Cretaceous blue shale with intercalated calcareous siltstone and limestone (Roma Formation, Lower Aptian; Tambo Formation, Middle-Upper Albian). In the Eromanga and Surat Basins, these beds in turn are followed conformably by Upper Cretaceous lacustrine shale, sandstone, limestone and coal seams (Winton Formation) up to 2,200 ft. thick. In the Carpentaria Sub-Basin, only Blythesdale, Roma and Tambo equivalents are known.

In the Maryborough Basin, thick trachytic and andesitic tuffs (Grahams Creek Volcanics) are overlain conformably by 6,000 ft. of marine shale, siltstone, sandstone and limestone (Maryborough Formation) of Lower Aptian age. These beds are followed conformably by Upper Cretaceous lacustrine sandstone and shale with coal (Burrum Coal Measures).

Near Stanwell, west of Rockhampton, the Lower Cretaceous coal measures contain a very thin marine band of Valanginian age.

In the Laura Basin, probable Blythesdale and Roma equivalents are developed.

Cainozoic

Cainozoic continental sediments are widespread in Queensland. They consist mainly of thin Tertiary conglomerate, sandstone, mudstone and limestone, and Quaternary alluvium. The Tertiary succession in eastern Queensland also contains beds of oil shale of limited extent.

Tertiary marine sediments are known only from a bore (H.B.R. No. 1) on Wreck Island off Gladstone.

Volcanics, mainly plateau basalts and rhyolitic and trachytic masses, are widely distributed in northern and eastern Queensland. Some are interbedded with continental sediments.

STRATIGRAPHIC TABLE—BOWEN BASIN

Age	Collinsville Area (after Reid, 1929)	Comet Area (after Derrington and Morgan, 1959)	Springsure Area (after Springsure 4 mile geol. map—Hill, 1957)	Cracow–Theodore Area (after Derrington and Morgan, 1959)
			Bundamba Group	≡ Bundamba Group
			unconformity	*unconformity*
Triassic	Redcliffe Fmn≡Carborough Fmn		Moolayember Shale Clematis Sandstone	≡ Moolayember Shale ≡ Clematis Sandstone
			unconformity	
			Rewan Fmn	
			unconformity	
Permo-Carboniferous	Bowen System: Upper Bowen Coal Measures	Taurus Fmn	Bandanna Fmn	Theodore Group: Isla Fmn, Kia-Ora Fmn, Gyranda Fmn
	Bowen System: Middle Bowen Group: Middle Bowen Marine "Series"	Crocker Fmn Maria Fmn	Mantuan Downs Fmn Catherine Sandstone Ingelara Beds Serocold (≡ Aldebaran) Sandstone	Back Creek Group: Mount Steel Fmn, Passion Hill Fmn, Acacia Fmn, Orange Creek Fmn, Oxtrack Fmn
	Bowen System: Middle Bowen Group: Collinsville Coal Measures		Cattle Creek Fmn ≡ Sirius Shale	
	unconformity		*unconformity ?*	*unconformity*
	Bowen System: Lower Bowen Volcanics: Mount Devlin Volcanics		Staircase Sandstone Stanleigh Shale	Camboon Volcanics
	Bowen System: Lower Bowen Volcanics: Mount Devlin Coal Measures		*unconformity*	
	Bowen System: Lower Bowen Volcanics: Mount Toussaint Volcanics		Orion Shale	

STRATIGRAPHIC TABLE—GREAT ARTESIAN BASIN

Age	Carpentaria Sub-Basin (after Laing and Power, 1959)	Eromanga Sub-Basin (after Whitehouse, 1955)	Surat Sub-Basin (after Whitehouse, 1955 and Jenkins, 1959)
Tertiary	Lynd Fmn	Glendower Fmn	
	unconformity	*unconformity ?*	
		Eyrian Fmn	Eyrian Fmn ≡ Telgazli Fmn
		unconformity ?	*unconformity*
Cretaceous	Normanton Fmn Kamileroi Limestone Blackdown Fmn Gilbert River Fmn ≡ Wrotham Park Sandstone	Winton Fmn, Tambo Fmn, Roma Fmn: Rolling Downs Group Blythesdale Group	Tambo Fmn Roma Fmn Blythesdale Group ≡ Griman Creek Fmn
	unconformity		
Jurassic	Inoruni Sandstone	Walloon Coal Measures Marburg Sandstone	Walloon Coal Measures Marburg Sandstone
	unconformity	Bundamba Group	Bundamba Group
		unconformity	*unconformity*
Triassic		Moolayember Shale Clematis Sandstone	Moolayember Shale Clematis Sandstone
		unconformity ?	
Permian	Croydon Granite and Croydon Felsite (Permian ?) (basement)	Mantuan Downs Fmn Colinlea Fmn	

STRATIGRAPHIC TABLE—MARYBOROUGH BASIN

(After unpublished reports by W. F. Ridley and W. L. Hawthorne)

Age	Formations
Tertiary	volcanics Elliott Fmn volcanics
	unconformity ?
Cretaceous	Burrum Coal Measures Maryborough Fmn
	unconformity ?
	Grahams Creek Volcanics
	unconformity
Jurassic	Watalgan Granite (intrudes Tiaro C.M.) Tiaro Coal Measures
Triassic	Myrtle Creek Sandstone Brooweena Fmn Stony Range Volcanics
	unconformity
Permian	Gympie Group

STRATIGRAPHIC TABLE—MORETON BASIN

Age	Formations
Tertiary	Silkstone Fmn Redbank Plains Fmn
	unconformity
Cretaceous	
Jurassic	Walloon Coal Measures Marburg Sandstone Bundamba Group
	unconformity
Triassic	Ipswich Coal Measures { Blackstone Fmn; Cooneana Fmn; Tivoli Fmn; Kholo Sub-Group. Brisbane Tuff } Andesitic volcanics ? ?
	unconformity
Palæozoic ?	Metamorphics, intruded by granite

CONCLUSION

Many indications of oil and gas have been found in Queensland, but as yet no commercial accumulations are known. The most significant indications were found in the Roma district. The wet gas there may be of commercial importance, if sufficient reserves can be proved. This gas is believed to have been derived from Palaeozoic marine sediments elsewhere in the Great Artesian Basin and to have migrated to its present position. Most of the shows of dry gas in Queensland were probably derived from coal. The occurrences of wax are of little value in indicating the proximity of oil.

Over 200 wells and scout bores have been drilled for oil in Queensland, but few have been located on known structures. There have been unfortunate tendencies:

(*a*) To drill close to water bores in which oil or gas shows were met,

(*b*) To drill structures poorly defined from inadequate surface mapping or gravimetric survey only.

The 12,000 or more artesian and sub-artesian bores drilled in the Great Artesian Basin have not effectively tested it for oil and gas. The average depth of artesian bores only is about 1,400 ft. The sub-artesian bores generally are shallower. Many water bores penetrated the marine Cretaceous, but of these, few were drilled on the anticlinal structures now known to exist in the Basin. Most of the bores bottomed in aquifers well above the horizon of the known oil reservoir beds (Triassic) of the Roma area, or the potential reservoir beds in the Palaeozoic sediments believed to underlie the Mesozoic beds of the Eromanga and Surat Sub-Basins. Of the first 4,500 water bores put down in the Great Artesian Basin between 1887 and 1928, only 233 penetrated below 3,000 ft. The deepest was Springleigh No. 3, which reached final depth of 7,009 ft. in 1921; the second deepest, Bulgroo, bottomed at 5,517 ft.; only two other bores penetrated below 5,000 ft.

At the time of writing, December 1959, interest is centred on the deeper middle portions of the Great Artesian Basin, where 5,000 + ft. of Mesozoic sediments are believed to overlie an even greater thickness of Palaeozoic sediments, and many large domes have been discovered.

PART 2

WELLS DRILLED FOR OIL OR GAS

The following pages contain a review of all the wells drilled specifically for oil or gas in Queensland. It includes the location of the wells, depths, rig type, casing details, stratigraphy and showings, if any, which were found. The review is set out in alphabetical order with respect to the company or syndicate for whom the drilling was carried out, and conforms to the standard nomenclature adopted by the Queensland Department of Mines for reference to oil wells (i.e. name of operator—number of well—locality).

Tabulated at the end of this review, is a list of bores drilled for water or other purposes from which indications of oil or gas were verified by analysis, and a list of bores in which oil or gas has been reported and which are considered significant. Appended to the text are gas, oil and water analyses.

Alton Downs

See Melrose Petroleum Prospecting Co. Ltd.

Arcadia

See O.S.L. No. 3 (Arcadia)

Associated Australian Oilfields N.L. No. 1 (Roma) (Fig. 4)

This well is located on the eastern slope of Timbury Ridge, 34 chains north-west from the south-eastern corner of portion 143, parish of Roma, 4 miles east of the township. Rotary table elevation was 1,128 ft. above sea level, 5 ft. above ground surface.

The site was selected on a geophysical "high" defined by Bureau of Mineral Resources gravity and reflection surveys.

Drilling with rotary plant (Sullivan 300A) began on 20th March, 1952, and total depth of 3,897 ft. was reached on 10th August.

Post-Cretaceous clay and gravel were penetrated from surface to 45 ft. Roma Formation to 200 ft., Blythesdale Group to 770 ft., Walloon Coal Measures to 2,772 ft., Bundamba Group to 3,259 ft. and Moolayember Shale and possibly older sediments to 3,897 ft.

In the Walloons porous water sands occur from 1,230–1,390 ft., resting on greenish sandstone containing oolites of siderite or chamosite to 1,435 ft. Good coal seams occur between 1,933 ft. and 2,332 ft.

The base of the Bundamba Group is marked by a shale pebble conglomerate. Similar rock was met at 3,015–3,027 ft. in R.B.O. No. 3.

At 3,567 ft., 2½ ft. of dark-brown argillaceous sandstone was cored. On examination this proved to consist of rounded quartz grains in a brown- to honey-coloured clay matrix, part of which is bentonitic. A similar rock was found in cores from R.B.O. No. 3 at 3,311–3,314 ft. This may prove a good marker bed because the clay matrix and rounded quartz suggest stable conditions.

At 3,878 ft. a hard, pale greenish-white, compact silt with siderite nodules and pellets was entered, which persisted to total depth, 3,897 ft. A thin section of this rock shows clay and siderite cement between quartz grains without sign of metamorphism. The rock appears to have suffered fracturing, subsequently filled with siderite. This rock may correlate with "oolitic carb. rock" noted at 3,721-3,729 ft. in O.S.L. No. 1 (Warooby), 34 ft. above granite basement, and is very similar to rocks penetrated in C.O.L. No. 1 well, north of Chinchilla, just above the base of the Mesozoic sequence.

Several packer tests were made without production. With packer seat at 3,733 ft. and bottom at 3,897 ft. a ten minute test gave gas at the rate of 6,500 cu. ft. per day at 90 p.s.i. flow pressure, but this was not in economic quantity. The only report of oil was at 3,785 ft. when a thin streak of fine sandstone showed a positive chloroform cut and fluorescence.

Water was not recorded, though normally it would be expected in sandstones of the Blythesdale Group, Walloon Coal Measures and Bundamba Group. No water was recorded during tests.

No samples of gas, oil or water were collected. The only casing used was 186 ft. of 9⅝ in. casing cemented to surface. The hole was kept in good condition by controlling the drilling mud; cores were taken at 50 ft. intervals to 2,991 ft. and continuously from 3,037 ft. Cores were cut with 5⅜ in. bits and the hole reamed to 7⅝ in.

Before abandoning the well, cement plugs were set at 3,655–3,705 ft., 180–200 ft. and surface to 35 ft.

A.A.O. No. 2 (Roma) (Fig. 4)

This well is located on portion 473, parish of Euthulla, approximately ¼ mile east of R.B.O. No. 4, ¼ mile south of R.B.O. No. 1, and 6·7 miles north-north-east of Roma. Ground level at the site is 1,092·5 ft. above sea level and rotary table elevation, from which all depths were measured, was 1,097 ft.

The well was spudded on the 6th October, 1952, using a Sullivan 300A rotary plant, and reached total depth of 3,616 ft. on the 3rd February, 1953. The objective of the well was to check and test oil sands logged in R.B.O. No. 4 at 3,497–3,508 ft., 3,566 ft. and 3,572 ft.

Drilling commenced with an 11 in. hole to 160 ft. and 9⅝ in. casing was run to 154 ft. and cemented to surface. From 160 ft. to 2,985 ft., 7⅞ in. hole was drilled and below this depth the hole was cored at intervals with a 5⅜ in. bit. and then reamed to 7⅞ in. On reaching basement 6⅝ in. casing was run to 3,593 ft. and cemented over the bottom 440 ft., the casing being seated approximately 20 ft. below the lower oil sand.

The penetrated section consisted of Roma Formation to 261 ft., Blythesdale Group to 1,101 ft., Walloon Coal Measures to 2,261 ft., Bundamba Group to 3,101 ft., Moolayember Shale to 3,598 ft. and granite wash and decomposed granite basement to 3,616 ft. The section from 3,477 ft. to 3,599 ft. of the Moolayember Shale, has been correlated with the Hospital Hill Sandstone, from which gas and condensate were obtained at Hospital Hill, Roma.

As in A.A.O. No. 1 and R.B.O. No. 3, the base of the Bundamba Group is marked by a shale pebble conglomerate; correlation with A.A.O. No. 1 shows the Bundamba-Moolayember contact to be 121 ft. higher stratigraphically.

Examination of the cores indicated three horizons to be tested within the Hospital Hill Sandstone. These were "oil sands" at 3,549 ft. 4 in.–3,553 ft. 10 in. and 3,517 ft.–3,521 ft. and a "gas sand" at 3,477 ft.–3,489 ft. The lithological character of the formation 3,477 ft.–3,489 ft. suggests it is equivalent to the upper oil sand in the R.B.O. No. 4 bore. A core of the section 3,477 ft.–3,495 ft. consisted of sandstone in the top 12 ft., with shale and carbonaceous laminations in the upper 9 ft. but porous and clean in the lower 3 ft. One foot of black shale separated this bed from a 3 in. band of sandstone giving an ether cut and fluorescence under ultra-violet light. Beneath this zone was 4 ft. 6 in. of sandstone, compact and laminated at the top, but more porous towards the bottom of the core. A formation test using a rat hole packer was made over the section 3,452 ft.–3,510 ft., but no production was obtained.

After the well had been cased, production tests were carried out over the intervals mentioned previously. The first test was on the section 3,549 ft. 4 in.–3,553 ft. 10 in. Casing was perforated between 3,550 ft. 10 in.–3,552 ft. 4 in. and the hole swabbed, but only saline water with slight oil films and some gas was produced. Subsequent examination of the cores by the Bureau of Mineral Resources indicated that the upper part of this sand had a much higher porosity and the oil/water ratio was also higher. The perforations from the previous test were cement-sealed and the interval 3,522 ft. 3 in.–3,553 ft. 3 in. was then shot-perforated but with little success, the quantity of oil in the oil/water mixture remaining at about 1½ per cent. This horizon was plugged and the casing between 3,518 ft. 6 in. and 3,519 ft. 6 in. was perforated, producing small quantities of gas and saline water. Without sealing the perforations, further tests were made on the upper gas sands; the casing between 3,480 ft. and 3,485 ft. was shot resulting in a flow of salt water (70 gallons per hour) with a scum of oil and a little gas. However, it was uncertain whether the flow was coming in from the upper "gas sand" or the lower "oil sand" but in either case there was no production and it was decided to abandon the well.

Cement plugs were set opposite all perforations, the casing cut at 3,114 ft. and pulled. Cement plugs were also set from 3,114 ft. to 3,144 ft., 2,950 ft. to 3,000 ft., 2,200 ft. to 2,250 ft. and 9⅝ in casing was plugged top and bottom. The hole was finally abandoned on the 27th April, 1953.

A.A.O. No. 3 (Roma) (Fig. 4)

This well is located 40 chains bearing 103° (magnetic) from the north-west corner of portion 473, parish of Euthulla. It is 6·3 miles bearing 16½° east from Roma railway station. Ground level at the site is 1,085 ft. above sea level and rotary table elevation, from which all depths were measured, was 1,090 ft.

Drilling commenced on the 4th August, 1953, using a Sullivan 300A rotary plant, and was abandoned as a dry hole at 3,644 ft. on the 26th November, 1953. This well was located so that it would penetrate the Hospital Hill Sandstone down-dip from the R.B.O. No. 4 bore, a westerly dip being computed from the available information. However, on the completion of drilling it was clear that the structure below the Bundamba Group has a south-westerly dip in the Block 16 area, so that this well was located up-dip from R.B.O. No. 4.

The section penetrated consists of Roma Formation from surface to 245 ft., Blythesdale Group to 1,105 ft., Walloon Coal Measures to 2,290 ft., Bundamba Group to 3,056 ft. and Moolayember Shale to 3,597 ft.

The Blythesdale Group is composed of three distinct units; mainly water-bearing sandstone from 245 ft. to 385 ft., shale and coaly shale with thin coal bands and beds from 385 ft. to 535 ft., and sandstone containing many red garnets from 535 ft. to 1,105 ft.

The Moolayember Shale can be divided into two formations on lithological and electrical characteristics. From 3,056 ft. to 3,473 ft. the lithology is shale and argillaceous sandstone, generally calcareous, with low self-potentials. The interval 3,473 ft.–3,597 ft. consists of sandstone and shale with sandy partings. The sandstone is commonly porous and contains oil, water and some gas. The interval shows high self-potential and resistivity properties distinct from the overlying sediments, and therefore constitutes a lithological unit. It is correlated with the beds (Hospital Hill Sandstone) from which gas and condensate were obtained at Hospital Hill, Roma.

At 3,597 ft. the well penetrated granitic material which shows definite evidence of a clastic origin to a depth of 3,600 ft. Below this depth, to bottom at 3,644 ft., the material is weathered, but no information was obtained to identify it as true basement or granite wash.

The change of electrical properties at each stratigraphic boundary, except the top of the Hospital Hill Sandstone, is quite sharp and definite, suggesting that the contacts are disconformable. This is supported by the presence of oxidised shales at 1,105 ft.

Altogether nineteen cores were cut. Cores were taken at 3,134 ft. and 3,156 ft. to locate the shale

pebble conglomerate at the base of the Bundamba Sandstone and coring was continuous from 3,332 ft. to 3,604 ft. Positive showings of oil were obtained from nine separate intervals of core from the section 3,486 ft.–3,584 ft., and oil was visible in the pore space in five of these intervals.

Porosity determinations made on eight different sands between 3,488 ft. and 3,555 ft. gave an average porosity of 20 per cent. with the range from 13 per cent. to 24 per cent.

Formation tests using a Halliburton Tester and Wall Packer, were carried out on the section 3,469 ft.–3,567 ft., with the packer set immediately above the most promising sands. Only one test gave a positive result, that being over the interval 3,469 ft.–3,501 ft. During a 30-minute test, 6.4 cu. ft. of saline water, some gas and a trace of oil were produced from the sandy beds between 3,486 ft. and 3,492 ft.

The evidence obtained from this well indicates that porosity and permeability are not constant, and vary both laterally and vertically within each sandstone bed. This has resulted in the formation of porous sandstone lenses enveloped by sandstones of low permeability. Gas and/or oil is confined to the porous portions of the formation at a pressure somewhat below hydrostatic pressure; this porous lens when punctured by a well may lose some pressure to the hole and under test will produce a quantity of fluid proportional to the pressure and volume of the lens. When this volume has been removed, there is no means of recharge of the pore space because of the surrounding relatively impermeable formation. This was borne out by the behaviour of the sand between 3,486 ft. and 3,491 ft. During the first test this sand produced gas and saline water but when tested again, only drilling mud filtrate was produced, showing that no replenishment of the formation fluids had taken place after the first test.

These conditions explain why wells such as R.B.O. No. 1 and No. 4 produced oil when first tested but did not react to production tests, and why production tests on A.A.O. No. 2 well were unsuccessful. Other wells in the area have punctured small lenses of porous formation and so gave insignificant production or failed to react at all.

The individual oil sands occupy different positions within the sequence so that correlation of the oil-bearing beds from well to well is not possible. It has been shown that the discontinuity of permeability is regional and therefore caused by depositional irregularities. A poorly sorted sand from 3,542 ft. to 3,556 ft., which showed gas in the core but gave no production on test, illustrates the lack of permeability of individual strata.

The only casing used in the well was 104 ft. of $8\frac{5}{8}$ in casing cemented to surface. On completion of testing, cement plugs were set at 3,450 ft.–3,600 ft., 3,050 ft.–3,070 ft., and 2,250 ft.–2,300 ft. The well was left uncapped and was later converted for use as a water well.

A.A.O. No. 4 (Hospital Hill) (Fig. 5)

This well is located 120 ft. north-west from the corner of Bower and Cottell Streets, Hospital Hill, Town of Roma. Ground level at the site is 1,035 ft. above sea level and rotary table elevation was 1,040 ft.

The hole was drilled with a Sullivan 300A rotary plant; drilling commenced on the 14th January, 1954, and reached a total depth of 3,891 ft. The well was closed down after testing on the 22nd July, 1954.

An 11 in. hole was drilled to 310 ft. and $7\frac{7}{8}$ in. hole was carried to total depth. Coring was continuous from 3,645 ft. to 3,891 ft., cores being cut with a $5\frac{3}{8}$ in. core bit, and the hole reamed to $7\frac{7}{8}$ in. A surface string of $8\frac{5}{8}$ in. casing was set at 300 ft. and cemented to surface; $6\frac{5}{8}$ in. casing was run to 3,775 ft. and cemented to 3,240 ft.

The succession penetrated consisted of Roma Formation, from surface to 290 ft. followed by the Blythesdale Group to 1,360 ft. This group is made up of four distinct units:—from 290 ft. to 535 ft., the "Transition Stage" mainly of grey and dark-grey mudstone, fine argillaceous and calcareous sandstone and some beds of thin impure limestone; from 535 ft. to 720 ft., the Mooga Sandstone consisting of fine to medium grained argillaceous sandstone with some minor dark- and light-grey shale; the "Fossil Wood Stage" from 720 ft. to 890 ft. consisting of dark-grey shale with many carbonaceous bands and thin coal seams; and from 890 ft. to 1,360 ft. the Gubberamunda Sandstone of white uncemented quartzose sandstone with very minor shaly bands (Reeves, 1947).

From 1,360 ft. to 2,675 ft. the Walloon Coal Measures consist of grey carbonaceous shale with some thin coaly bands and minor sandstone; and from 2,675 ft. to 3,295 ft. the Bundamba Group consists mainly of medium to coarse partially cemented sandstone with minor bands of light- to dark-grey shale. The base is marked by an intraformational conglomerate. The Moolayember Shale, occurring from 3,295 ft. to 3,882 ft., is separated from the Bundamba Group by what appears to be a major unconformity. To 3,683 ft. the formation consists of grey shale with some minor well cemented sandstone. At 3,683 ft. a minor unconformity (?) occurs; from that point to 3,882 ft. the sequence is one of medium to coarse porous sandstone containing water and gas, and grey carbonaceous shale. This member has been named the Hospital Hill Sandstone; the upper member is as yet unnamed.

Basement was met at 3,882 ft. and penetrated to 3,891 ft., this interval being thought to represent the old soil formed on the basal complex of metamorphosed pelitic rocks.

Several features were noted in this well which may have value for correlation purposes in future wells in this area:

(1) A noticeable concentration of red garnet in the basal 100 ft. of the Gubberamunda Sandstone.

(2) The quartz grains of the thin interbedded sandstones of the Walloon Coal Measures are subrounded and frosted.

(3) The quartz grains of the sandstone of the Bundamba Group are subangular and clear.

(4) A bed of grey mudstone with numerous pisoliths and nodules of siderite occurs from 3,735 ft. to 3,741 ft. This zone probably coincides with the "buff shales" noted in previous wells on Hospital Hill.

(5) A zone of black shale with calcite pisoliths occurs from 3,826 ft. to 3,829 ft.

No evidence of petroleum was found in any of the cores, but gas was noted in cores at four different depths between 3,683 ft. and 3,880 ft. In the interval 3,685 ft.–3,699 ft., gas bubbling was noted in the core when pulled, and in the core between 3,699 ft. and 3,714 ft. strong gas bubbling was seen. Also, when drilling this section, the drilling mud was strongly gas cut. Some gas activity was noted in the core between 3,818 ft. and 3,826 ft. and a small amount of gas with much saline water was recorded between 3,869 ft. and 3,880 ft.

Formation tests were carried out over the section 3,676 ft.–3,891 ft. The intervals were 3,676 ft.–3,699 ft., 3,693 ft.–3,714 ft., 3,797 ft.–3,831 ft. and 3,844 ft.–3,891 ft. Two of these intervals gave production under test; the interval 3,693 ft.–3,714 ft. yielded gas and the section 3,834 ft.–3,891 ft. produced saline water with a small proportion of dissolved gas.

A production test was made on the gas sand; the casing between 3,700 ft. and 3,716 ft. was perforated and the gas sand put on test for 28 hours. The sand produced gas at the rate of 870,000 cu. ft. per day through a $\frac{3}{8}$ in. bottom hole choke and the maximum closed in pressure was 500 p.s.i. At the beginning of the test a small amount of water was blown free with the gas but the quantity decreased to insignificant amounts towards the end.

The well was mudded off with viscous 1·9 sp. gr. mud and the master gate closed pending future testing. The salinity of water from 3,869 ft. to 3,879 ft. was 2,600 p.p.m. chloride. The analysis of gas from the test was: Oxygen 0·2 per cent.; carbon dioxide 0·5 per cent.; nitrogen 0·8 per cent.; methane 83·1 per cent.; ethane and higher homologues 15·4 per cent.

A.A.O. No. 5 (Hospital Hill) (Fig. 5)

This well is located on Hospital Hill, Roma, in Town Lot 79F and 2,442 ft. on a bearing of 328° from A.A.O. No. 4. Ground level at the site is 1,019 ft. above sea level and rotary table elevation was 1,024 ft.

Drilling commenced on the 9th August, 1954, with a Sullivan 300A rotary plant, and the well was abandoned after testing on the 15th March, 1955, at a total depth of 4,079 ft. An 11 in. hole was drilled to 155 ft., a $7\frac{7}{8}$ in. hole to 4,020 ft. and a $5\frac{3}{8}$ in. hole to 4,079 ft. The only casing used was a surface string of $8\frac{5}{8}$ in. casing seated at 153 ft. and cemented to the surface.

The lithology in this well correlates closely with the lithology in A.A.O. No. 4, though some differences in formation thickness are evident. The well penetrated:

Roma Formation from surface to 290 ft.

Blythesdale Group—290 ft. to 1,327 ft., with four distinct units, viz.: "Transition Stage"—290 ft. to 505 ft., mainly light-grey mudstone and sandy mudstone, shale and fine-grained sandstone with some interbedded impure limestone; Mooga Sandstone—505 ft. to 730 ft., essentially sandstone, very fine-grained, argillaceous, micaceous at the top to coarse sandstone at the base; "Fossil Wood Stage"—730 ft. to 825 ft., mainly light- to dark-grey shale, slightly carbonaceous in part; Gubberamunda Sandstone—825 ft. to 1,327 ft., fine- to coarse-grained friable argillaceous sandstone, with some shaly bands.

Walloon Coal Measures—1,327 ft. to 2,700 ft. Essentially shale interbedded with sandy shale and sandstone. The shale is light- to dark-grey, slightly carbonaceous in part, with some thin coaly bands. The sandy shale and sandstone are fine-grained, carbonaceous, light-grey and friable in part.

Bundamba Group—2,700 ft. to 3,328 ft. Porous sandstone, medium grained quartzose, poorly cemented, with some dark carbonaceous to light-grey shale and sandy shale.

Moolayember Shale—3,328 ft. to 4,070 ft. Interbedded fine-grained argillaceous sandstone and light- to dark-grey shale mark the top. These are underlain by alternating beds of dark-grey carbonaceous shale, sandy shale and moderately fine- to medium-grained sandstone (the Hospital Hill Sandstone). In the lower section, moderately to highly carbonaceous and bituminous shale predominates. An increasing frequency of narrow beds of pebble conglomerate is evident towards the base. Dips are generally flat to 5°, somewhat uneven.

Basement—4,070 ft. to total depth. This section is marked by a conspicuous major unconformity with the overlying beds. It comprises light-greenish and greyish-green, indurated, interbedded mudstone, siltstone and shale having a dip of 40°. The age of these beds is unknown.

Thirty-two cores were cut; the first was taken from 3,539 ft. to 3,554 ft. and the remainder were taken from 3,616 ft. to total depth. Showings of gas were logged in eight separate sections of core between 3,539 ft. and 4,018 ft. and some irridescent oily patches were seen in the mud from 3,539 ft.

Thirteen formation tests were made, in only one of which was gas produced in measurable quantities. No oil was produced. The Hospital Hill gas sand, which was initially the principal objective, was tested twice while coring. After coring to total depth the hole was plugged back to 4,012 ft. to test a possible oil sand at 4,002 ft., but this zone proved barren. The hole was then plugged back to the base of the Hospital Hill gas sand at 3,739 ft. Three attempts were made to induce production of gas by injecting dieseline, followed by swabbing, but without success. The first attempt was unsuccessful due to packer seat failure. The second attempt, which was mechanically successful, covered the whole section of the gas sand from

3,700 ft. to 3,739 ft. Formation water and a little gas were produced. When measured this was at the rate of 1,040 cu. ft. of gas and 119 barrels of water per day. An estimated 97 barrels of mud filtrate and 409 barrels of formation water were produced.

The hole was then plugged back to 3,710 ft. for re-test of the upper section of the sand. Persistent efforts to induce a flow of either gas or water were, however, unsuccessful, though 310 barrels of formation water were swabbed out. It was concluded that the well was situated below the edge water limit at this part of the structure.

Cement plugs were set between 4,079 ft. and 3,600 ft., 2,700 ft. and 2,650 ft., 750 ft. and 698 ft. and the well abandoned for conversion to a water well to 698 ft.

A.A.O. No. 6 (Hospital Hill) (Fig. 5)

This well is located 181 ft. bearing 325° from the point of the acute angle formed by Miscamble Street and Queen Street, Hospital Hill, Roma. Ground level at the site is 995 ft. and the rotary table elevation was 1,005 ft.

The well was drilled with a National T32 rotary plant; drilling commenced on the 7th June, 1955, and reached a total depth of 4,285 ft. The well was abandoned as a dry hole on the 3rd August, 1955. Drilling commenced with an 11½ in. hole to 175 ft., then 7⅞ in. hole to 4,272 ft. and 5⅜ in. rat-hole to total depth. The only casing used was a 172 ft. string of 8⅝ in. casing, which was cemented to surface.

The section penetrated consists of Roma Formation from surface to 310 ft., Blythesdale Group to 1,385 ft., Walloon Coal Measures to 2,710 ft., Bundamba Group to 3,350 ft., and Moolayember Shale to 4,209 ft. From 4,209 ft. to 4,285 ft., basement consists of hard, indurated, black and green shale, and white, well-cemented quartzose sandstone dipping at 50–60°. The age of these beds is unknown.

In general the lithology of the rocks encountered in this well is similar to the lithologies met in A.A.O. No. 4 and A.A.O. No. 5, with the exception that in A.A.O. No. 6 the Moolayember Shale appears to contain many more thin beds of coal than in A.A.O. No. 4.

A.A.O. No. 6 was sited to be on or near the axis of the inferred continuation of the Hospital Hill Anticline. However, the axis does not appear to be continuous, and in this well the top of the Hospital Hill Sandstone is some 60 ft. lower than in A.A.O. No. 4.

Two intervals of the well were cored. Firstly from 3,600 ft. to 3,746 ft. coring was continuous and was designed to core through the expected gas sand, and secondly between 4,213 ft. and 4,285 ft. two further cores were taken to obtain a sample of basement.

No indications of oil or gas were seen either in the cores or in the drilling mud. Formation tests were carried out over the intervals 3,605 ft.–3,636 ft., 3,696 ft.–3,726 ft. and 3,920 ft.–3,955 ft., the only production being small quantities of very saline water from the latter two sections.

Cement plugs were set from 4,285 ft. to 3,600 ft., 2,700 ft. to 2,650 ft., 750 ft. to 700 ft., and 50 ft. to surface and the well abandoned.

A.A.O. No. 7 (Arcadia) (Fig. 6)

The well is located at lat. 25° 17′ 54″ S., long. 148° 47′ 43″ E., approximately 40 miles north-north-east of Injune. It was spudded-in on 8th April, 1957, and abandoned as a dry hole at a total depth of 3,280 ft. on 14th July, 1957. A Sulivan 300A rotary plant was used. The rotary table elevation was 1,227 ft., 5 ft. above the ground surface.

The site is one mile east of the crest of the Arcadia Anticline and the well was designed to test the gas prospects of the Permian sedimentary formations. A tentative stratigraphic correlation by the Company is as follows:—

Surface–845 ft. ..	Upper Bandanna Formation
845–1,160 ft. ..	Lower Bandanna Formation
1,160–1,480 ft. ..	Catherine Sandstone
1,480–2,200 ft. ..	Ingelara Beds
2,200–2,290 ft. ..	" Transition Beds "
2,290–2,760 ft. ..	Cattle Creek Formation
2,760 ft.–bottom	Staircase Sandstone

Twelve core samples were taken at intervals between 170 ft. and 2,951 ft. Fresh-water and marine fossils obtained from these cores assisted in correlation.

Packer tests were carried out at 2,795½ ft., 2,818½ ft. and 2,919½ ft. A small quantity of gas was obtained in the third test at 2,919½ ft. but this was of no commercial importance. Electric logs were taken and these indicated that no potentially productive horizons had been penetrated.

Eight and five-eighths inch casing was cemented in from the surface to 420 ft. The diameter of the hole below 420 ft. ranged from 7⅞ in. to 5⅜ in. On abandonment the well was plugged from 400 ft. to 430 ft. and from the surface to 20 ft.

A.A.O. No. 8 (Karumba) (Fig. 7)

This well is located 4½ miles north of the Karumba Pilot Station, Gulf of Carpentaria, at lat. 17° 24′ 36·6″, long. 140° 52′ 21·9″ E. Rotary table elevation was 20 ft. above mean sea level, and 5 ft. above surface. The well was drilled 5,000 ft. to the west of the crest of the Karumba gravity high. The contractor was Mines Administration Pty. Ltd., and the rig a Sullivan 300A. The drilling was subsidised by the Commonwealth Government under the *Petroleum Search Subsidy Act*, 1957–58. The well was spudded in on 6th February, 1958. Eleven inch hole was drilled to 205 ft. and 8⅝ in. 36 lb. casing was run to 198 ft. and cemented to surface. Drilling of 5⅝ in hole was continued to total depth of 2,364 ft. Three cores were cut, at 1,303–1,323 ft., 2,191–2,195 ft. and 2,363–2,364 ft. The hole was logged electrically to total depth by the Bureau of Mineral Resources, with a Widco single-electrode unit. Resistivity and natural potential curves were recorded.

The strata penetrated were as follows:—

Surface–70 ft.	Beach deposits, etc.	Quaternary
70–129 ft.	Lynd Formation	Tertiary
129–1,610 ft.	Normanton Formation	Cretaceous
1,610–2,277 ft.	Blackdown Formation	
2,277–2,360 ft.	Wrotham Park Sandstone	
2,360–2,364 ft.	Basement	

The Quaternary section from surface to 70 ft. consisted mainly of shell fragments with minor sand.

The Lynd Formation was mainly a quartz sand with minor amounts of shell fragments and laterite pebbles.

The section from 129 to 260 ft. consists of red and white sandy laterite, similar to the laterite developed at Normanton. This is underlain by weathered Normanton Formation from 260 to 304 ft. and unweathered Normanton Formation from 304 to 1,610 ft. The formation consists mainly of shale, with minor amounts of sandstone. Sandstone is dominant at the top of the section, whereas it is almost absent towards the base of the formation.

From 1,610 to 2,277 ft. shale with minor amounts of sandstone, are assumed to be equivalent to the Blackdown Formation.

The placing of the base of the Normanton Formation is founded on the same evidence as for F.B.H. No. 1 (Wyaaba), and the same conclusion regarding its accuracy holds.

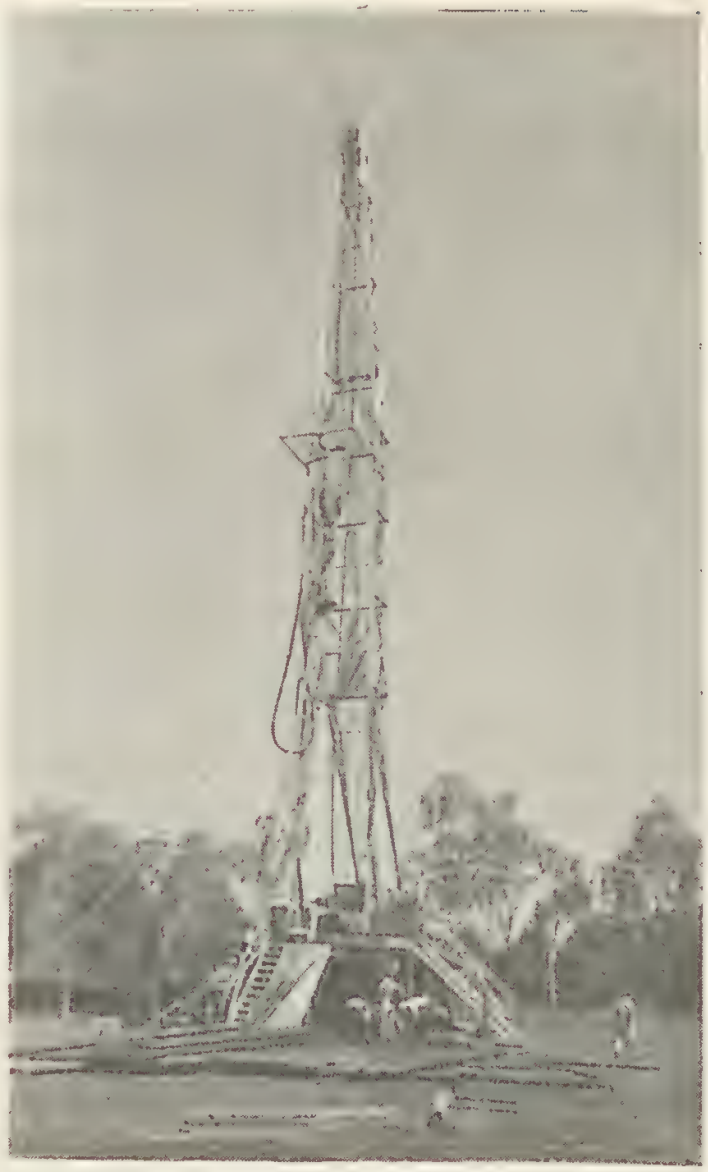
The section from 2,277 to 2,360 ft. consists of interbedded shale and medium-grained quartz sandstone, and is correlated with the Wrotham Park Sandstone.

Basement of granitised quartzite was met at 2,360 ft.

A gas smell was noticed in the mud return pipe and in the cuttings at 1,599 ft.; the cuttings gave a positive acetone test. Another positive acetone test was obtained in cuttings from shales at 1,828–1,838 ft. Cuttings from sandstone at 2,279–2,281 ft. showed slight yellow fluorescence, brown staining and a positive acetone test. Cuttings from sandstone at 2,301–2,303 ft. showed strong yellow fluorescence, brown staining and a positive acetone test. A formation test was carried out on the Wrotham Park Sandstone with the hole at total depth, and with the packer set at 2,279 ft. After 28 minutes, artesian water flowed from the top of the drill pipe 8 ft. above the rotary table. The well was plugged and abandoned on 3rd March, 1958.

Associated Freney Oil Fields N.L. Cooroorah No. 1

This well was located at lat. 23° 07′ 30″ S., long. 148° 42′ 40″ E., on an anticline defined by surface geological mapping, gravimetric and seismic methods. The drilling was subsidised by the Commonwealth Government under the *Petroleum Search Subsidy Act*, 1957–58. The rig was a National T32, and the drilling contractor was Mines Administration Pty Ltd. Rotary table elevation was approximately 605 ft. Drilling began on 25th October, 1959, and progress depth on 31st December, 1959, was 2,822 ft.



Rigging up to test the Cooroorah structure. National T32 rig at site of A.F.O. Cooroorah No. 1 well.

Australian Oil Corporation No. 1 (Beaudesert)

The well is situated on the southern boundary of portion 23, parish of Beaudesert, 5 chains west from the Brisbane-Mt. Lindesay road.

The well was drilled in 1924, one chain west from Dunn's Bore, sunk in 1922, which reportedly showed a seepage of 5 gallons of oil at 77 ft.

Formations penetrated were Recent alluvium to 116 ft., clay and sand of Tertiary age to 353 ft. and Mesozoic (?) trachy-dolerite to 385 ft., the final depth.

Gas was reported at 224 ft. and definite traces of oil at 77 ft., 84 ft., 93 ft. and 228 ft. Water was shut off by casing to 216 ft. The well was abandoned.

A.O.C. No. 2 (Beaudesert)

This shallow well was sunk late in 1924, 170 ft. east from A.O.C. No. 1, to prove the validity of the original seepage in Dunn's Bore. It was abandoned at 112 ft., having penetrated clay, sand, pebble beds and impure limestone. No trace of oil was recorded.

L. C. Ball considered the oil showings to be of vegetable origin. The original seepage oil is recorded as consisting of 95 per cent. kerosene and 5 per cent. lubricating oil.

Australasian Oil Exploration Ltd. No. 1 (Reid's Dome) (Fig. 8)

This well is located 29 miles south-west from Rolleston at lat. 24° 47′ 25″ S., long. 148° 19′ 18″ E. Rotary table elevation, from which all depths were measured, was 979·7 ft., the ground elevation being 969·7 ft.

The well was spudded-in on the 30th August, 1954, and completed at a total depth of 9,060 ft. on the 20th April, 1955. The drilling was done on contract by Petroleum Drilling Corporation Ltd., using a National 50 rotary plant.

The well was sited on Reid's Dome, which is a culmination within the Serocold Anticline. Drilling commenced almost at the base of the Aldebaran Sandstone, of Permian age. At a depth of 70 ft. there is a marked lithological change from arenaceous to argillaceous estuarine type of sediments, and this depth probably marks the base of the Aldebaran Sandstone. This Permian estuarine sequence extends down to 1,695 ft. and consists predominantly of shaly beds with intercalated thin silts and limestones. Marine fossils were found in the interval 190 ft.–200 ft. From 1,695 ft. to approximately 2,000 ft., there is a conformable transition to freshwater conditions—lacustrine beds characterised by the presence of coaly beds and a Permian *Glossopteris* flora. Drilling was continued into this sequence for over 7,000 ft. and was finally abandoned, still in the same formation, after traces of igneous activity and localised zones of metamorphism had been encountered.* This section from 70 to 9,060 ft. is correlated with the Cattle Creek Formation. The marine or estuarine beds consist mainly of dark carbonaceous shale with minor thin beds of limestone. The shale may be sandy, silty, or calcareous. Carbonaceous matter is finely divided and uniformly distributed. Parts of the shale contain coarse rounded grains of sand with a few small erratic pebbles and joints infilled with calcite.

The strata beneath the marine beds consist of a very thick monotonously uniform sequence of tight carbonaceous sand and coaly anhydritic shale. The coaly layers are generally only a few feet thick, and are commonly split by shaly laminations.

Crystalline graphite encountered in the cuttings from a depth of 8,025 ft. was found to be associated with a 2 ft. thick band of a dark-green igneous rock—probably a micro-diorite—at 8,022 ft. Below this the formation reverted to carbonaceous shale with coaly sections. In a core taken at 8,818–8,835 ft., a quartz veinlet was seen; a core at 8,937 ft. contained graphitic shale which showed evidence of induration throughout.

In all, 37 cores were taken at various intervals, in most cases 20 ft. cores being cut, with the core recovery ranging from 1 ft. to 20 ft.

Numerous showings of oil and gas were obtained mainly in the section above 3,500 ft.

Aerial view of the Reid's Dome structure, showing the truncated axis.

*Final report on A.O.E. No. 1 (Reid's Dome). Webb (1956) later divided the succession thus: 0–70 ft. Aldebaran Sandstone; 70–1,695 ft. Cattle Creek Shale; 1,695–6,300 (?) ft. "undivided freshwater sediments"; 6,300 (?) ft. unconformity; 6,300–9,060 ft. "lower shales and mudstones".

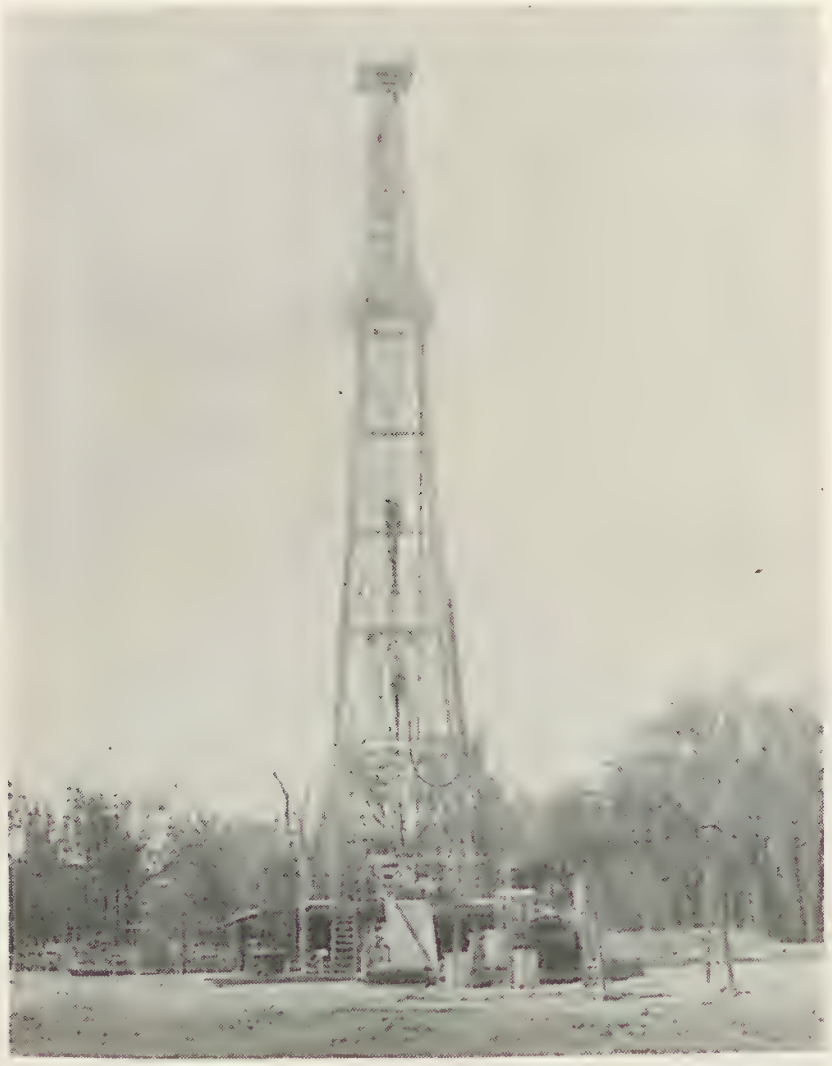
Oil showings were recorded from—

Core 5 1,745–1,764 ft.—Faint bleeding of green oil giving patchy but strong fluorescence

Core 8 2,309–2,326 ft.—Slight oil bleeding in fine-grained sandstones with thin coaly shale partings.

Core 15 3,454–3,474 ft.—Slight oil bleeding and oily smell from 4 feet of fine-grained silty sandstone

In addition, 21 sidewall cores taken between 483 ft. and 3,367 ft. showed fluorescence.



A.O.E. No. 1 (Reid's Dome). The rig is a National 50.

During the drilling operations, gas broke through the drilling mud at a depth of 466 ft. Subsequently a drill stem test over the interval 448 ft.–467 ft. yielded a gas flow of 550,000 cu. ft. per day. Analysis of the gas showed the methane content to be 97·4 per cent. with carbon dioxide 1·2 per cent.; oxygen 0·5 per cent.; nitrogen 0·9 per cent. Further small gas shows were recorded from 2,699 ft.–2,716 ft. and 4,460 ft.–4,477 ft. (Table III).

Due to the great distance of the well from a potential market, no action was taken to utilise this gas.

In all, twelve drill stem tests were made to a depth of 6,545 ft. Subsequently another was attempted at a depth of 7,853 ft., where the electric log and sidewall core showed a fracture zone which was possibly gas-bearing. However, in spite of reaming operations, the packer failed to pass the interval 4,400–4,500 ft. and in view of the condition of the hole, further testing was considered to be impossible.

Porosity and permeability determinations were made on cores from 464 ft., 2,711 ft. and 4,132 ft. Porosities ranged from 12 to 18 per cent. and permeabilities from 0 to 19 millidarcies.

The conclusions reached from the drilling of this well were ". . . that these oil shows represent residual traces. Apart from the three cores showing slight oil bleeding no really definite staining was observed throughout the entire section. It is highly probable that the drill stem tests, the rare slight oil bleeding and the more sensitive fluorescence tests, indicate pre-existing reservoirs which are now largely depleted." (Completion report on well A.O.E. No. 1 by K. R. Miles.)

Cement plugs were set from 2,190 to 2,230 ft., 295 to 445 ft. and 10 ft. to surface, and the hole abandoned.

A.O.E. No. 2 (Reid's Dome) (Fig 8)

This well is located on the southern culmination of Reid's Dome at lat. 24° 51′ S., long. 148° 19′ E., approximately 33 miles south-west of Rolleston. Rotary table elevation from which all depths were measured, was 1,219·3 ft.; the ground elevation is 1,208·3 ft.

The well was spudded-in on the 2nd June, 1955, and completed at a depth of 4,060 ft. on the 13th July, 1955. Drilling was by Petroleum Drilling Corp., through their sub-contractors Santa Fe Drilling Co., using a National 50 rotary plant. The well was drilled to test, up-dip, a number of water-filled sands encountered between 1,700 ft. and 4,220 ft. in A.O.E. No. 1 (Reid's Dome). In A.O.E. No. 1, two drill stem tests were mechanically unsuccessful and it was intended to test the sands again in the No. 2 well.

The upper 70 ft. of section consists of Quaternary alluvium—unconsolidated deposits of sand, gravel and clay. Below is the Cattle Creek Formation of Permian age which is divided into an upper transitional sequence and a lower continental sequence. From 70 ft. to 1,310 ft. are the transitional beds with depositional environment varying from continental to marine. They consist of quartz sandstone, mostly with a clay matrix, grey and brown shale carrying marine fossils and some erratic pebbles, carbonaceous and micaceous shale and siltstone with plant remains, often pyritic, thin limestone beds and subordinate amounts of gypsum and some coal. It is difficult to distinguish lithologically between these deposits and the underlying continental deposits. However, the former are characterised on the electric log by a lower mean resistivity than the continental deposits, and an obvious increase in resistivity at 1,310 ft. is taken as the base of the transitional deposits.

The Permian continental deposits occupy the section from 1,310 ft. to 4,060 ft., total depth. The lithology is not greatly different from the transitional beds, the main point of difference being the absence

of marine fossils. This section is more arenaceous than the overlying beds and consists of quartz sandstone, commonly calcareous, carbonaceous and micaceous shales and siltstones, a few thin fresh-water limestones and some coal.

Micro-diorite was met from 2,757–2,798 ft. and from 3,306–3,312 ft. These are probably sills. The micro-diorite may be genetically related to the igneous rock in A.O.E. No. 1, which occurs at a depth of 8,022 ft. Stratigraphical correlations of the two wells indicate that A.O.E. No. 2 well is 600 ft. higher structurally than A.O.E. No. 1.

Ten formation tests were made between 716 ft. and 4,060 ft., but no oil or gas was produced. A sand tested between 716 ft. and 736 ft. was found to be water-filled but all other sands were dry.

Sixteen cores were taken between 81 ft. and total depth, as well as nine sidewall cores from the interval 2,744 ft.–3,417 ft. Only one core, from 724 ft. to 734 ft., showed fluorescence and no evidence of oil or gas was seen in the other cores.

The only casing used in the well was a surface string of 13⅜ in. casing seated at 210 ft. and cemented to surface.

Cement plugs were set at 1,620 ft. to 1,600 ft., 210 ft. to 190 ft., 10 ft. to surface, and the well abandoned.

A.O.E. No. 3 (Consuelo) (Fig. 8)

This well is located on the Consuelo Anticine, approximately 15½ miles west-south-west from Rolleston. Coordinates of the position are lat. 24° 33′ 40″ S., long. 148° 23′ 20″ E. Ground level at the site is 988 ft. above sea level and rotary table elevation, from which all depths were measured, was 1,000 ft.

The well was drilled by the Santa Fe Drilling Company using a National 50 rotary plant. Drilling began on the 1st September, 1955 and was completed at a total depth of 4,437 ft. on the 1st November, 1955.

The Consuelo Anticline is a closed anticline approximately 12 miles long and between 2 and 3 miles wide; it lies to the east of and parallel to, the Serocold Anticline. The structure closes in the Aldebaran Sandstone, and the well was drilled primarily to test this formation.

The sequence consists of Aldebaran Sandstone from surface to 2,130 ft., Cattle Creek Formation to 3,200 ft. and undifferentiated beds to total depth.

The Aldebaran Sandstone consists mainly of quartz sandstone, quartz conglomerate and some carbonaceous shale, with numerous thin coal seams. The deposits are of fresh water origin and electric logging indicates that porosity is up to 25%.

The Cattle Creek Formation consists predominantly of shale, silty shale and siltstone. The shale is usually dark grey-brown and includes both carbonaceous and marine types. Some thin limestone beds are interbedded with the shale; and sandstone, when it occurs is usually fine-grained and tight. The top of the formation is fairly well defined at 2,130 ft. but the base is indefinite, as there is a gradation from freshwater to marine conditions. However, by electric log correlation with A.O.E. No. 2 well, the base of the formation has been placed tentatively at 3,200 ft.

Below the Cattle Creek Formation the beds are undifferentiated and cannot be correlated with the beds occupying the same stratigraphic position in the wells on Reid's Dome, either in lithology or by electric logging. These beds consist mainly of dark shale, carbonaceous between 3,200 ft. and 4,140 ft. and pyritic below this depth.

Three formation tests were made on the Aldebaran Sandstone, but in none of these was any indication of oil or gas found. In the first test over the interval 355 ft. to 428 ft., the formation was water-filled; in the second test on the interval 1,400 ft. to 1,477 ft. the packer failed to hold both in the test and on the re-run. The third test, made with the hole at 1,610 ft. and packer set at 1,493 ft., recovered 190 ft. of watery drilling fluid. No formation tests were made in the Cattle Creek Formation.

At the conclusion of drilling, cement plugs were set at 2,180 ft. to 2,102 ft., 206 ft. to 195 ft. and 10 ft. to surface, and the well abandoned.

Australian Oil and Gas Corporation Ltd. Scout Bores Nos. 1 and 2 (Talbalba)

These bores are located 80 miles south-east of Cunnamulla, at lat. 28° 58′ 8″ S., long. 146° 33′ 58″ E. Bore No. 1 is 117 ft. south of water bore Reg. No. 4654 ("Talbalba No. 6"), and bore No. 2 is 500 ft. north-east of the water bore. Surface elevation of both bores is approximately 460 ft.

The object of drilling was to test the reported occurrence of oil at 723 ft. 6 in. in the water bore. The holes were drilled between July and December 1957, wth an Hydromaster 1500 percussion plant. Both were begun at 6 in. diameter. No. 1 was abandoned at 774 ft. without reducing hole-size. In No. 2, water was encountered at shallow depths, and a 494 ft. string of 6 in. pipe was cemented in. Below this depth, a 5 in. hole was drilled to 1,000 ft. On completion of drilling, aquifers were sealed off with cement plugs.

Sludge samples were taken at frequent intervals during the drilling, but no coring was done. There was no electric logging.

The first 130 ft. of strata in the bores consist of siliceous gibber and sandy clay, which were believed to be of Tertiary age. The underlying beds are shale, silty shale, siltstone and sandy shale. These strata yielded Lower Cretaceous foraminifera between 365 and 768 ft. in No. 1, and between 336 and 995 ft. in No. 2.

No oil or gas shows were reported.

Salt water was struck in No. 1 bore at 62 ft. In No. 2 bore, salt water was struck at 22–30 ft. and 152 ft.; brackish water, flowing at the rate of 1,000 gallons per day, was struck at 560–600 ft.

A.O.G. No. 1 (Noondoo)

In 1958, Australian Oil and Gas Corp. Ltd. had intended to subsidise deepening of Noondoo Trust Bore, then drilling, for stratigraphic information. The name A.O.G. No. 1 (Noondoo) was used for this bore in correspondence. Subsequently, after further consideration of the geological data available, the corporation decided not to proceed with its plan.

A.O.G. No. 2 (Mirri Mirri) (Fig. 9)

This well was begun as a water bore, I.W.S.C. Reg. No. 13683. Drilling from 3,000 ft. to total depth, 4,645 ft., was paid for by Australian Oil and Gas Corp. Ltd., for the purpose of obtaining stratigraphic information. The well is located at lat. 27° 31′ S., long. 149° 55' E., 13 miles bearing 173° from Meandarra. Elevation of the site is 998 ft. The drill was an Hydromaster 1500, owned by Mr. A. Moy, of Miles. The bore reached 3,000 ft. on 20th November, 1958, and was completed as a non-flowing water bore on 25th May, 1959.

Six inch casing was run to 196 ft., and pressure cemented in February 1958. Five inch casing was run to 4,603 ft. To complete the bore as a water producer, the 5 in. casing was cut at 190 ft. and the surface lengths removed to allow the insertion of a pump within the 6 in. casing. The 5 in. casing was slotted at 2,340 ft., 2,370 ft., 3,205 ft., 3,615 ft. 4,125 ft., 4,345 ft., 4,400 ft. and 4,500 ft.

The bore was logged by the driller from surface to total depth and lithologically from 2,960 ft. to total depth. A gamma ray log was run by Mines Administration Pty. Ltd. from surface to 3,725 ft.; unfortunately the sonde could not be run below this depth as it was limited by its construction to operation at temperatures below 140°F.

The company's geologist, Dr. T. B. H. Jenkins, divided the section stratigraphically thus:

0– 70 ft.	Telgazli Formation
70–2,340 ft.	Rolling Downs Group (with marine beds probably between 700 and 1,200 feet)
2,340–4,625 ft.	Blythesdale Group
4,625–4,645 ft.	Walloon Coal Measures

with the possible alternative correlation:

2,340– ?	Blythesdale Group
? –3,960 ft.	Walloon Coal Measures
3,960–4,645 ft.	Marburg Sandstone and/or Bundamba Group

No shows of oil were met. A slight show of gas was met at 4,570 ft.

Australian Roma Oil Ltd. No. 1 (Hunterton)

The well was drilled between October 1928, and September 1929. It is situated 4 miles north-west from Hunterton, which is on the Roma–Injune railway line. Surface elevation is 1,235 ft.

Walloon Coal Measures were penetrated to 1,114 ft., Bundamba Group to 1,895 ft. and brown shale and sandstone of Moolayember Shale to 2,402 ft. Eight feet of metamorphic rock were drilled before reaching granite. Total depth after re-measurement was 2,424 ft.

Gas in bailings was recorded from 450 ft. and between 2,020 ft. and 2,310 ft. Only traces of oil were reported. Water is present in the Bundamba Group and at 2,295 ft.

All casing was removed and the well abandoned.

A.R.O. No. 2 (Gubberamunda)

The well is located on portion 37, parish of Gubberamunda, county of Waldegrave, 20 miles north from Roma. It was drilled in 1929. Surface elevation is 1,258 ft.

The Bundamba Group was reached at 1,620 ft. and persisted to 2,170 ft. Metamorphic bedrock was reached at 2,773 ft., and drilling ceased at 2,831 ft. in November 1929.

Gas is recorded at 2,080 ft. with water, and 2,734 ft. Oil shows were reported from 2,255 ft. to 2,325 ft. and somewhat above 2,694 ft.

Water was recorded at 155 ft., 170 ft., 735 ft., 1,526 ft. and 2,080 ft. Upper waters were shut off by seating 10 in. casing at 519 ft. Eight inch casing was cemented at 1,911 ft., and 6 in. casing was clay-sealed by spudding it into 80 ft. of clay when hole bottom was at 2,765 ft. Records show 2,774 ft. 6 in. of this casing in the hole. Tests proved a successful water shut-off by this method, after which the hole was deepened to 2,832 ft.

Re-measurement of total depth gave 2,853 ft., and this figure appears to have been adopted during the testing attempts.

Between November 1929, and April 1931, several attempts were made to test the lower part of the hole by setting the 6 in. casing at different depths and with plugs and packers, but all were failures due to water invasion.

If 2,853 ft. is the true depth of the hole, then the 6 in. casing was clay-sealed at 2,774 ft. when the bottom of the hole was 2,794 ft. Drilling reports show that 8 ft. of sandstone was drilled below the shoe of the casing before bedrock was reached, and that the hole to bottom was dry. This would constitute an effective test of the lower 8 ft. of sandstone. The reports do not mention drilling out 20 ft. of clay below the casing shoe so it cannot be assumed that this section was effectively tested. It is very probable that the method of sealing the casing also sealed at least 80 ft. of formation against relatively low pressure formation fluids.

Testing operations consisted of pulling the 6 in. casing to about 1,750 ft., re-running and unsuccessfully cementing at 2,625 ft., cutting at the fourth length and cementing again at about 2,545 ft. Water came in after drilling through the cement. Attempts to plug the hole back to 2,700 ft. (old measurement) and test brown shales, obtained showings of gas and oil before water flooded again.

The well was abandoned in April 1931, without effectively testing the oil indications at 2,255 ft. or 2,694 ft.

A.R.O. No. 3 (Mooga)

This well is situated 12 miles north from Roma near the north-east corner of portion 83, parish of Mooga. Surface elevation is 1,141 ft. The well was drilled with rotary plant between February and October 1929.

Formations penetrated were: Blythesdale Group from surface to 450 ft., Walloon Coal Measures to 1,922 ft., Bundamba Group to 2,450 ft. and Moolayember Shale to 3,132 ft. The Company representatives placed basement at 3,209 ft., but L. C. Ball's decision of 3,132 ft. is accepted.

Gas shows are recorded with coal, in the Walloon Coal Measures, at 2,080 ft. and from 2,815 ft. to basement. Oil is recorded from brown oil shale at 1,720 ft. and between 2,800 ft. and basement. This latter section was tested and gave a seepage only. Water occurs at 1,284 ft. A sample from 2,817 ft. was analysed as oil shale. No free oil was found in the sample.

The only casing recorded is 11¾ in. casing cemented at 2,814 ft. and plugged at the surface with cement. Cores were taken at intervals from 1,976 ft. The hole was tested by bailing but only seeps of oil and little gas were obtained.

The well was abandoned by filling with mud, placing a cement plug from 2,825 ft. to 2,800 ft., cutting and pulling the 11¾ in. casing from 1,140 ft. and placing a 7 ft. plug of concrete and wire line 5 ft. below the surface.

A.R.O. No. 4 (Blythdale)

The well is situated 20 chains north-east from Blythdale Railway Station, which is 11 miles east of Roma. Surface elevation is 1,019 ft.

Drilling commenced on 18th April, 1929, and ceased on 29th November, 1929. Attempts were made to produce oil until November 1930, when the Company suspended the effort. A final attempt was made in April, 1932, to pump out the flooded sands and induce a flow of oil, but the well was then abandoned.

Stratigraphic intervals penetrated are:—Roma Formation from surface to 295 ft. Blythesdale Group to 870 ft., Walloon Coal Measures to 2,670 ft., Bundamba Group to 3,280 ft., Moolayember Shale to 3,866 ft. Granite was drilled for 38 ft. to total depth of 3,904 ft.

Gas was recorded from 1,730 ft., 1,830 ft., 2,520 ft., 3,656 ft. and 3,844 ft. (Table III.)

Oil indications are recorded at 1,844 ft. and 3,814 ft. and an oil sand from 3,844 ft. to 3,850 ft. (Table IV.).

Water occurred at 368 ft. (saline), 373 ft., 464 ft., 644 ft., 3,284 ft. and 3,850 ft.–3,860 ft. The bore flows from 3,850 ft. or from a higher aquifer leaking behind the casing. (Table V). A temperature of 140° F. is recorded of bailings, presumably from near bottom.

Cores were taken from 1,490 ft. at irregular intervals to bottom.

Fifteen-and-a-half-inch casing was cemented at 115 ft.; 11¾ in. casing was cemented at 3,333 ft. With bottom at 3,850 ft., the hole was bridged to 3,843 ft. with a 7 ft. wooden plug, and 8⅝ in. casing run and cemented at 3,843 ft.

Testing began by bailing to 1,035 ft. (cement inside the casing was at 3,336 ft.) to check the casing. As no leak was apparent the core barrel was run to drill out the cement to 18 in. below the shoe and test the cement seal. Reports claim no core was recovered and the drill had penetrated the cement, but no qualifying explanation is recorded. Bailing began and with the level reduced to 1,200 ft. the hole was making water "which may be from behind the casing or water forced into the oil sand in trying to get circulation." Bailing continued and gas began to blow with the water at 750 ft. (this is either a mistake or refers to depth of water in the hole, i.e. water level at 3,100 ft. approximately). The gas had a petroliferous smell and burnt with a yellow flame. Bailings from bottom showed oily streaks and rock fragments considered to come from behind the casing.

When bailing ceased the water flowed over the casing at 80 gallons per hour, thus proving to the operators that it was coming from an aquifer and not from the oil sand.

The hole was deepened 10 ft. by coring, during which the rate of flow increased to 1,000 gallons per hour. White coarse grit recovered in the core barrel gave coloration to chloroform test. Coring continued to granite at 3,865 ft. and on to 3,904 ft.

Tubing was run, and it is recorded that the formation took water at 150 p.s.i. pressure and the flow pressure was 35 p.s.i.

Cement (24 sacks) was pumped with tubing at 2,899 ft., followed by pulling back 160 ft., circulating with clean water to remove cement from the tubing and a further half-hour circulation under pressure. A pressure of 250 p.s.i. was left in the well for 7 days, and when released the well was quiet. The cementing was tested and proved a water seal.

Coring from the shoe gave the following results:—After 15 in., water flowed at 60 gallons per hour, a further 6 in. core caused the flow to increase to 120 gallons per hour; another 6 in. core induced further increase without gas or oil; 18 in. was then cored and gas became active (at 3,847 ft. approximately). Underreaming was done for 3 ft. to clean the walls of the hole but only colours resulted. There is no record of water flow rates after reaming.

Continuous bailing resulted in reduction of water flow and gas activity, and black wax was collected from the bailings. The water level was about 500 ft. at this time. Subsequently it was reduced to 2,200 ft., when both water and gas became more active and several pints of crude oil were collected. The operators concluded that the reduction of hydrostatic pressure caused the cement plug in the bottom of the hole to move and release water and oil from below 3,847 ft.

The well was filled with water and left to stand for 5 days. The overflow was only 1½ gallons, showing that artesian water was sealed off. Bailings from bottom brought up wax and lighter oil.

Check measurements with sand line and drill pipe made the top of the cement plug 3,843 ft. 5 in. and 3,843 ft. 8 in. below the table. Another drill pipe measurement made the plug 3,845 ft. and the casing shoe 3,841 ft. 5 in. below the rotary table. (Presumably depths of formation changes were recorded from the rotary table, in which case the casing shoe is 2 ft. 6 in. above the top of oil sand at 3,844 ft. and at best, only 1 ft. of this sand was open to the hole at this stage.).

The hole was cleaned out and reamed to 10½ in. diameter for 6 ft. 9 in. below the casing shoe with increase in water flow.

A lead plug was placed in the hole so as to leave 3 ft. 9 in. of open hole below the casing, and bailing lowered the fluid level to 2,450 ft. Water and oil activity was greater than before reaming and plugging. The lead plug lifted 3 in. during tests.

The operators concluded that an oil sand exists in the 3 ft. 9 in. section below the casing, and that this had been cemented off in the original cementing operation.

An expanding rubber packer was designed and set above the lead plug. Bailing showed effective water shut-off but oil and gas were also restricted. Acid treatment was not effective.

Records of subsequent testing are wanting, but it is recorded that in May 1930, water with gas and oil films flowed at the rate of 1,800 gallons per hour. A pilot absorption test on the gas gave 7½ pints of gasoline per 1,000 cu. ft. of gas.

It is assumed from notes that the 8⅝ in. casing seal failed and had to be recemented, and a 6¾ in. liner run to 3,868 ft., cemented and perforated at about 3,859 ft. Bailing showed water flow of 327 gallons per hour and gas activity. This perforation was cemented up and another perforation made at 3,848 ft. which produced water.

It was decided to abandon the well and the bottom of the hole was plugged with cement. The top of the cut 8⅝ in. casing was capped with cement (no record of when or where cut), the 11¾ in. casing pulled and the hole filled with heavy mud. A plate was welded over the 15 in. surface casing.

A.R.O. No. 5 (Blythdale)

The well is situated on reserve 61, parish of Blythdale. Surface elevation is 1,014 ft.

Drilling commenced on 30th December, 1929, and ceased at 3,848 ft. 6 in. on 24th October, 1930, without reaching bedrock.

Blythesdale Group was penetrated from surface to 707 ft. The base of the Walloon Coal Measures cannot be determined accurately from the graphic log as no thick sands were recorded, and coal occurs within the interval expected to represent the Bundamba Group. In thickness considerations, the top of the Bundamba Group is placed at 2,500 ft. and the top of the Moolayember Shale at 3,200 ft.

Gas was recorded at 1,230 ft., with coal, 1,876 ft., 2,950 ft. to 3,122 ft., 3,216 ft., 3,730 ft., 3,770 ft. and 3,830 ft. No wet gas was analysed from this well. (Table III).

Oil was recorded between 3,769 ft. and bottom, the strongest occurrences being at 3,830 ft. and 3,847 ft. Table IV).

Water was reported at 186 ft. and flows from 3,102 ft. and 3,830 ft. (17,000 gallons per day; temp. 170° F.).

Selective coring commenced at 1,500 ft. and was almost continuous from 3,635 ft. Surface casing, 15 in. diameter, was cemented at 110 ft., 8⅝ in. casing was cemented at 3,760 ft.

The section 3,760 ft. to 3,780 ft. was tested by bailing but failed to produce fluid. Artesian flow from 3,830 ft. was accompanied by gas and oil. Efforts to shut off water and produce from the upper part of the sand, 3,830 ft.–3,834 ft., which showed oil in cores, failed. A liner was set at 3,834 ft. and further coring showed water and oil sands to 3,848 ft.

The operators decided that the oil and water were located in the same sand and endeavoured to obtain oil production by pumping water at the rate of 50,000 gallons per day and allowing the oil to separate out.

No details of results are available, but it is recorded that in 1932, pumping caused A.R.O. No. 4 to cease flowing.

A.R.O. No. 6 (Cornwall)

The well is situated 37 miles north-west from Roma on Flagstone Creek, parish of Cornwall. Surface elevation is 1,334 ft.

The well was drilled with rotary tools to 300 ft. by Roma Cornwall Dome N.L. between 12th August, 1927, and 10th September, 1929. It was taken over by Australian Roma Oil and deepened to 2,306 ft. by 7th April, 1930.

Blythesdale Group was penetrated from surface to 523 ft., Walloon Coal Measures to 1,228 ft., Bundamba Group to 1,756 ft., Moolayember Shale to 2,234 ft. and pre-Mesozoic slates to 2,306 ft.

No gas or oil is recorded from the well. Water is recorded at 1,230 ft. and 1,440 ft.

Cores were taken at intervals from 633 ft. A dip of 10° is recorded at 2,068 ft., 45° at 2,241 ft. and 56° at 2,255 ft.

No casing was used in the well. Testing consisted of bailing but the water level could not be reduced below 340 ft. The well was abandoned.

A.R.O. No. 7 (Solitary Creek)

This well is situated at the head of Solitary Creek, on portion 11, parish of Whithu, 20 miles north-east from Roma. Surface elevation is 1,361 ft.

Roma Mooga Oilfields N.L. drilled this well to 1,702 ft. with percussion plant between 27th March, 1929, and 2nd August, 1929. Australian Roma Oil Ltd. deepened the well to 3,609 ft. between 23rd April, 1930, and 31st May, 1932, using cable tools to 2,600 ft. and rotary to bottom.

Drilling logs show that the well penetrated Blythesdale Group from surface to 472 ft., Walloon Coal Measures to 1,897 ft., Bundamba Group to 2,545 ft. and Moolayember Shale of shale with sandstone and probably older sediments to 3,586 ft. Metamorphosed sediments, consisting of chert, indurated shaly sandstone and crystalline siliceous limestone, are recorded to total depth 3,609 ft.

Variegated green and red shales from 3,125 ft. suggest Rewan Formation; the sediments described as "soapstone" with coal from about 3,335 ft., are suggestive of the Bandanna Formation. The descriptions of soapstone suggest bentonitic clay, but drilling mud reactions suggest that gypsum or anhydrite is also present in the formation. Dr. H. I. Jensen correlates strata at 3,360 ft. in this well with those at 3,200 ft. in Stewart's Mooga N.L. No. 1. Dolomitic limestone was reported at 3,522 ft.

Gas is recorded from 1,400 ft., 1,458 ft., 1,702 ft., 1,800 ft. to 1,920 ft., 2,710 ft., 3,418 ft. to 3,450 ft.

Oil signs are recorded at 1,432 ft., 1,610 ft., 2,980 ft.–3,087 ft., 3,325 ft.–3,328 ft. and 3,354 ft.–3,357 ft. in cored sandstone, 3,386 ft.–3,427 ft. and 3,576 ft.–3,581 ft.

Water shows occurred at 170 ft. (200 gallons per day), 420 ft., 3,113 ft. to 3,150 ft. (oily) and 3,452 ft.

Cores were taken from 2,060 ft. to bottom. Dips recorded are 10° at 3,250 ft., 5° at 3,352 ft. and 15° in the metamorphics at 3,586 ft.

Ten inch casing was seated at 114 ft.; 8 in. casing was cemented at 2,555 ft.; 6 in. casing was cemented at 2,966 ft.; 4 in. casing was cemented at 3,318 ft.

Reports on testing this well are few and difficult to piece together. The bailing tests after the 6 in. casing was seated at about 2,900 ft. showed oil and gas entering the hole to 3,110 ft. but no clear water was bailed. Fluid level was not lowered beyond 640 ft. The casing was cemented at 2,966 ft. with bottom of hole at 3,150 ft., and tested successfully. When cleaning out, cement was met 23 ft. above the shoe, indicating that the casing was cemented for 180 ft. up the annular space between casing and walls of the hole. The cement was drilled to 4 ft. below the shoe and bailing commenced.

When all mud and cement-contaminated water had been bailed out, the level of gas- and oil-contaminated water in the hole was 463 ft. as against 600 ft. when bailing commenced. Thief bailing to bottom did not show any section of clear water or oil concentration, but gas was stronger towards bottom.

To ensure that the cement seal was not leaking, a pressure test was applied, but no change was noticed in the annular space, proving that there was no leak through the cement.

It was decided that the section under test, 2,966 ft. to 3,105 ft. (3,095 ft. to 3,140 ft. was filled with cavings) was too low in porosity to produce, and also that sub-artesian water beds existed with the oil and gas sands. (Before this test it was considered that this section was dry). In view of this, the decision was made to drill on, and re-test later if considered necessary.

The hole was deepened to 3,385 ft. where another bailing test took place. Thief bailing showed water entering the hole to about 3,180 ft. (with gas?) and gas and oil without water, from 3,246 ft. to bottom. Intensive bailing from this lower section gave gas, yellow oil and black crude oil. During this test the water level stood at 400 ft. and bailing at the rate of 400 gallons per hour maintained the level at 733 ft.

Operations were suspended in November 1931, with bottom at 3,536 ft. Re-measurement of the hole when reopened on 7th May, 1932, gave 3,543 ft. as bottom.

With depth at 3,610 ft. the bit stuck and drill-pipe parted at 2,046 ft. Reports covering fishing operations over three months are missing, but apparently the drill pipe was backed off, or shot off at 3,585 ft.; 4 in. casing was run and cemented at 3,318 ft., the hole cleaned out to the top of the fish and bailing commenced.

Water entered the hole at 3,452 ft. The hole was plugged from bottom to 3,460 ft. with sand and stones, and to 3,422 ft. with cement. Bailing over eleven days showed a reduction in static water level from 444 ft. to 710 ft. but subsequent bailing did not improve the position.

Records cease on 7th December, 1932. Apparently attempts to isolate and test the oil sections were abandoned.

A.R.O. No. 8 (Blythdale)

The well is located on reserve 61, parish of Blythdale, 1,000 ft. north-west from A.R.O. No. 5. Surface elevation is 1,037 ft.

Drilling with rotary tools commenced on 7th June, 1930 and total depth of 3,988 ft. was reached on 24th October, 1930.

The well penetrated Roma Formation from surface to 217 ft., Blythesdale Group to 756 ft., Walloon Coal Measures to 2,668 ft., Bundamba Group to 3,300 ft. and Moolayember Shale to granite basement at 3,872 ft.

The only gas recorded was from the lowest 6 ft. of sediments. Oil was recorded at 3,650 ft. and an oil sand with water from 3,856 ft. to 3,872 ft.

Cores were taken between 2,347 ft. and 2,531 ft., 3,300 ft. and 3,380 ft. and 3,540 ft. and bottom. Surface casing was cemented at 244 ft. and 8⅝ in. casing at 3,605 ft. This has since been removed.

The formations were tested by setting a packer at different depths and bailing the hole. Very little gas was evident but artesian water was obtained. The hole was filled and cemented back with the intention of sealing the lower part of the oil sand, but the cement was placed too high. There is no record of a thorough test being made.

A.R.O. No. 9 (Gunnewin)

Five shallow scout holes had been drilled before this well was begun by Kayenta Oil Prospecting Co. in October 1928. The well reached total depth of 2,104 ft. in September 1930. Australian Roma Oil supervised the later drilling and testing of the formation. Percussion tools were used.

The well was situated 7¼ miles west of Gunnewin, which is on the Roma-Injune railway. Surface elevation is 1,547 ft.

Walloon Coal Measures were penetrated from surface to 748 ft., Bundamba Group to 1,361 ft. and Moolayember Shale and older sediments to metamorphic bedrock at 2,060 ft. Dark and talcose slates were drilled for 44 ft. to total depth, 2,204 ft.

Gas was reported from 1,140 ft., 1,485 ft., in black sand at 1,590 ft. and at 1,682 ft., and 1,772 ft. In surrounding water and scout bores, gas was struck on several occasions in the Walloon Coal Measures. Analyses proved absence of petroliferous constituents.

Oil was recorded at 950 ft. and thence frequently to basement. In no case was there sufficient to collect, and many of the shows may have been caused by grease on the tools. Water was struck at 1,485 ft. and 1,705 ft.

Ten inch casing was seated at 844 ft., and 8 in. casing was cemented at 1,352 ft. An attempt was made to test the sands at 1,595 ft.–1,625 ft. by cementing 6 in. casing at 1,593 ft. after plugging the hole to 1,628 ft. with stones, sand and three bags of cement. The test proved non-productive, but mistakes in casing and cement measurements probably affected the results. All casing was removed and the hole abandoned.

A.R.O. No. 10 (Orallo)

This well is situated on portion 63v, parish of Bengalla, 21 miles north-west from Roma. It is also known as Roma Orallo Ltd. No. 1. Surface elevation is 1,162 ft.

It was drilled with percussion tools between 2nd September, 1929, and 20th September, 1930.

Formations penetrated were Blythesdale Group from surface to 462 ft., Walloon Coal Measures to 1,825 ft., Bundamba Group to 2,396 ft. and Moolayember Shale to 2,835 ft.; quartzite, schist and metamorphosed tuff were drilled to 2,863 ft.

Gas was reported from about 2,800 ft., and oil and gas showings from 2,833 ft. to 2,835 ft. Water occurred at 350 ft., 440 ft., 1,030 ft., 1,755 ft., 1,825 ft., 1,900 ft. and 2,285 ft.

Ten inch casing was set at 152 ft., and 8 in. casing followed the bit. With bottom at 2,822 ft. the hole was bailed. Slight showings of gas and oil were noted but were of no consequence. No water came into the hole. When drilling 2,833 ft. to 2,835 ft., gas and oil showings were recorded, but bailing to 2,000 ft. with bottom at 2,863 ft. gave less and less gas production, proving no accumulation. The well was abandoned.

A.R.O. No. 11 (Blythdale)

This well is situated on portion 109, parish of Tingun, 400 yards south-east from Blythdale railway station. It is also referred to as East Roma Oilfield No. 1.

Drilling commenced on 24th June, 1929, with percussion tools, and total depth of 4,162 ft. was reached on 8th April, 1931.

The base of the Roma Formation was reached at 268 ft. No record of strata is available between 450 ft. and 783 ft., and hence the base of the Blythesdale Group cannot be located. Shales and sandstones with coal and brown shale were penetrated to 2,969 ft. This is greater than the normal thickness of Walloon Coal Measures, which may, perhaps, fill an erosion channel in the Bundamba Group. The base of the Bundamba Group was reached at 3,301 ft., Moolayember Shale and probably older sediments rest on granite basement at 4,135 ft.

Gas was recorded at 385 ft., 1,860 ft., 1,907 ft., 2,282 ft., 2,566 ft., 3,909 ft. and while bailing the lower part of the hole. Oil occurred at 4,123 ft.–4,129 ft. in arkose, and several pints were bailed from the top of the water column after the well was left to stand for several months.

Water was logged at 385 ft., 904 ft., 1,137 ft. and 3,971 ft. Temperature at 2,258 ft. was 131 F.

Coring commenced at 3,862 ft., with a Baker percussion barrel; cores from 3,876 ft. to 4,122 ft. showed dips of 5°–10°.

Casing used in the hole consisted of 20 ft. of 12 in. surface string, 960 ft. of 10 in. diam., 1,935 ft. of 8 in. cemented, 6 in. diam. cemented at 3,862 ft., a cemented liner from 4,110 ft. to 3,810 ft. All casing is reported to have been removed.

Interesting features of this well are the water recorded at 900 ft. to 1,000 ft. and 1,140 ft. to 1,210 ft. These aquifers flowed more than 100,000 gallons per day and appear from lithology to be in the Walloon Coal Measures. A richly garnetiferous sandstone recorded at 1,137 ft. may be useful for correlation purposes.

The well was bailed dry in March 1931, and only films of black oil and traces of gas were obtained. No water entered the hole. The hole was deepened to ensure bedrock had been reached, and was bailed dry, sealed and left to stand for 6 months. On re-opening, fluid level was at 500 ft., with about 5 quarts of light oil on top. A charge was exploded

in the hole to shatter the oil sand but subsequently the bailer was lost and it was five months before the hole was bailed to 3,650 ft.

No further records are available. Presumably the tests were non-productive.

A.R.O. No. 12 (Euthulla)

This well was drilled to 2,005 ft. by Mid-continental Mines Co., and deepened by Australian Roma Oil Ltd. to 3,020 ft.

It is situated on reserve 143, parish of Euthulla, 8 miles north-north-west from Roma. Surface elevation is 1,165 ft.

Drilling commenced on 1st November, 1928, and 2,005 ft. depth was reached on 21st September, 1929. Operations were resumed in November 1930, and ceased in April 1931.

The well commenced in sandy beds of the Roma Formation. Blythesdale Group was penetrated from 370 ft. to 1,000 ft.; Walloon Coal Measures to 2,310 ft.; Bundamba Group to 2,485 ft. and Moolayember Shale to total depth.

Gas was recorded at 1,988 ft. and analysed as carbon dioxide 1·4 per cent., methane 64 per cent., inert 30·6 per cent., air 4 per cent. Showings are recorded at 2,330 ft. with water, 2,440 ft., 2,856 ft. A sludge sample from 1,270 ft. gave 3·8 per cent. oil, but no major showings are recorded. Water was found at 373 ft., 510 ft., 760 ft., 1,165 ft. (rose to 100 ft.), 1,900 ft., 2,310 ft. and 2,815 ft.

At least the last 45 ft. of the hole was cored, but depths are doubtful owing to a re-measurement, which was not clearly recorded.

The hole was bailed when depth was 2,005 ft., but water flooded the hole and drowned out the small gas show. There is no record of further testing. All casing was removed from the hole.

A.R.O. No. 13 (Euthulla)

The well is situated on portion 411, parish of Euthulla, 6 miles north-west from Roma, at lat. 26° 30′ S., 148° 43′ 20″ E. Surface elevation is 985 ft. (approx.).

Drilling by Interstate Mines and Petroleum Ltd. commenced on 8th December, 1928, and was suspended in November 1929, at 1,480 ft. Australian Roma Oil Ltd. resumed drilling in November 1930, and reached total depth, 2,705 ft., on 31st March, 1931.

The section penetrated was Roma Formation to 628 ft., Blythesdale Group to 1,110 ft., Walloon Coal Measures to 2,460 ft. and Bundamba Group to 2,705 ft.

Gas was recorded from 330 ft., 1,360 ft., 1,437 ft., 1,620 ft., 1,758 ft., 1,888 ft. and 2,170 ft. to bottom. No analysis was made so shows are assumed to have been slight. Oil colours were seen at 910 ft. (sludge samples contained 1·4 per cent. free oil), 980 ft. (0·04 per cent. free oil), 1,060 ft. (15·7 per cent. free oil), 1,365 ft. and 2,000 ft.

Water was found at 330 ft., 355 ft., 618 ft., 730 ft. (flowed?), 1,000 ft. and 2,460 ft. (rose to 300 ft.).

Ten inch casing was seated at 1,112 ft., 8in. casing was seated at 1,898 ft., and 6 in. casing was run to near bottom. On completion of drilling all casing was removed.

With casing seated at 1,355 ft. and the hole dry, oil and gas showed from 1,360 ft. to 1,366 ft. while drilling was in progress. No samples were collected and conditions prove no quantity present. The section 1,480 ft.–1,493 ft. gave traces of oil and some gas when the fluid level was reduced to 300 ft., but no further record is available.

The hole appears to have been abandoned when tools were lost at 2,705 ft.

A.R.O. No. 14 (Blythdale)

This well is located 6 miles north from Blythdale, near the southern boundary of portion 105, parish of Blythdale. Surface elevation is 1,151 ft.

Drilling commenced on 17th January, 1931, and ceased on 30th April, 1931, at 3,544 ft.

The well penetrated Blythesdale Group from surface to 415 ft., Walloon Coal Measures to 2,429 ft., Bundamba Group to 3,060 ft. and Moolayember Shale to granite basement at 3,533 ft.

Gas was recorded at 3,400 ft. and from 3,480 ft. to 3,530 ft. Gas from the lower zone proved to be petroliferous and was estimated to flow at the rate of 5,000 cu. ft. per day (Table III).

Oil was reported from 283 ft. in the water bore put down near A.R.O. No. 14. The reservoir rock was carbonaceous sandstone. At 280 ft. in A.R.O. No. 14, brown shale was recorded. No other show was logged but numerous positive solvent tests were recorded. Water was recorded at 120 ft.

Eleven inch diameter casing was cemented at 415 ft. and 5¾ in. casing was cemented at 3,268 ft. Cores were taken from 40 ft. to 63 ft., 1,730 ft. to 1,905 ft., 2,105 ft. to 2,120 ft., 3,100 ft. to bottom.

The well was tested by bailing in September 1931, and petroliferous gas was obtained, but efforts to improve production above 4,000 cu. ft. per day were not successful. Absorption tests of the gas showed it to be three times more productive than the Roma gas.

Further bailing tests were made in May 1932. Some light oil was recorded but records cease before completion of the tests.

It is presumed the casing was withdrawn and the well abandoned.

A.R.O. No. 15 (Bungil)

This well is siutated on portion 156F, parish of Bungil, 4 miles south-west from Roma. Surface elevation is 993 ft.

Drilling by Roma Oil South Blocks commenced on 3rd January, 1929. Percussion tools were used to a depth of 3,735 ft. Australian Roma Oil Ltd. took

over at 3,735 ft. in March 1931, and drilled with rotary tools. Drilling ceased on 21st May, 1931, at 4,110 ft.

Formation boundaries were located at the following depths: Base of the Roma Formation 650 ft.; base of Blythesdale Group 1,555 ft.; base of Walloon Coal Measures 2,712 ft.; base of Bundamba Group 3,500 ft.; the Moolayember Shale rests on metamorphic basement at 4,090 ft.

Some gas was noted at 2,430 ft. and traces of oil and gas were logged at 3,600 ft. to 3,732 ft.

Water was reported at 650 ft. to 830 ft., 1,039 ft. to 1,139 ft., 1,475 ft., 1,965 ft., 2,795 ft. and from between 3,965 ft. and 4,000 ft.

Circulation was lost at 4,022 ft., but there is no record of how much was pumped to formation or of its subsequently being tested.

Cores taken in the lower section of the hole showed gentle dips. Ten inch casing was seated at 495 ft.; 8 in. at 2,002 ft. and 6 in. was cemented at 3,702 ft.

The well was tested by bailing at 3,742 ft., with bottom at 3,907 ft., without production. The section 3,965 ft.–4,000 ft. was tested with a packer and bailing tests, with negative results, though water entering would not allow reduction of fluid level below 1,050 ft. No test below 4,000 ft. is recorded.

A.R.O. No. 16

See R.O.C. No. 1 (Hospital Hill).

A.R.O. No. 17

See R.O.C. No. 3 (Roma).

A.R.O. No. 18

No record of the nature or location of this well is available.

A.R.O. No. 19 (Wallumbilla)

The well is situated on the north-western outskirts of Wallumbilla township, 24 miles east from Roma. Surface elevation is 1,042 ft.

Drilling commenced on 25th October, 1932, and reached a depth of 4,968 ft. in December 1933. Rotary equipment was used.

The log suggests Roma Formation extends to 508 ft., Blythesdale Group to 1,373 ft., Walloon Coal Measures to 3,380 ft., Bundamba Group to 3,480 ft., and Moolayember Shale to at least 4,200 ft. Brown and carbonaceous shale occurs to 4,219 ft. This is followed by sandstone and shale with greenish coloration and siderite nodules to 4,488 ft. and multi-coloured shale, including brown, red and grey, with sandy beds to 4,842 ft. The sediments from 4,842 ft. to bottom are mainly sandstone.

It is probable that the sediments below 4,488 ft., from which *Calamites* and (?) *Vertebraria* are recorded, are of Permian age. If this is so the greenish sideritic sediments may be equivalent to the lower Mesozoic sediments found in wells further east—C.O.L. No. 1 (Speculation), M.O.C. No. 1 (Boyanda) and A.R.O. No. 20 (Dalby)—and the overlying brown shales comparable with the Ipswich Coal Measures.

L. C. Ball considered 4,310 ft. as the base of the Mesozoic sediments with a slight angular unconformity, but this amounted, on average dips, to only one degree.

Comparison with A.R.O. No. 7, where coals from 3,471 ft. are considered to be of Permian age, suggests a general thickening towards the east of the pre-Bundamba section, particularly the Moolayember Shale and carbonaceous sediments immediately below. Sediments at 2,905 ft. in A.R.O. No. 7 may be correlated with those at 4,219 ft. in A.R.O. No. 19.

Gas was reported at 4,585 ft. and in the sandstone from 4,842 ft. to 4,958 ft. This latter proved to be petroliferous, but no volume was produced. (Table III.)

Odours of oil were noted in cores from 4,479 ft., 4,576 ft., 4,847 ft., and 4,911 ft. No sample was collected.

Water was logged at 511 ft., 680 ft., 1,880 ft., 1,944 ft.–2,000 ft., 2,299 ft., 3,596 ft., 3,800 ft. and 4,256 ft. No water was noted below 4,300 ft.

Water collected during swabbing tests, and considered to be leaking from above the casing shoe at 4,467 ft., contained 125 grains per gallon sodium chloride and 39 grains sodium carbonate, which is high for artesian waters.

Coring commenced at 3,600 ft., and was carried out almost continuously to bottom. Dips recorded average 10° to 4,600 ft. and 4° at 4,800 ft., the deepest recorded.

Eleven and three-quarter inch casing was cemented at 542 ft., 8⅝ in. seated at 1,813 ft., and 5¾ in. cemented (not effectively) at 4,467 ft. A 4 in. liner was cemented between 4,015 ft. and 4,768 ft.

In February 1934, the hole was tested from 4,467 ft. to bottom, 4,968 ft., by running tubing to 4,300 ft., displacing the drilling mud with water and swabbing the hole. After reducing the fluid level to 220 ft., the well flowed water, presumably from above the casing shoe. Petroliferous gas was noticed after swabbing for two days, and a sample was collected. This test, though a failure, proved presence of gas with some water in the lower part of the hole. (Water analysis above).

The 4 in. liner was cemented to 4,768 ft. and the hole again swabbed. With fluid level at 4,025 ft. water with very little gas entered the hole at 52 gallons per hour.

Gas was evident when pulling the tubing, and pressure built up when the well was closed in, but it was not proved that the gas and water occupied separate sands. The well was taken over as a town water well.

A.R.O. No. 20 (Dalby)

This well was drilled in 1934-35 by a subsidiary company, Australian Roma Oil (Dalby) Ltd., on behalf of the Dalby Council, for water to 3,500 ft., and on behalf of Australian Roma Oil Co. to any greater depth.

It is situated to the north-west of town reserve 167. Surface elevation is 1,125 ft.

The well was drilled with rotary tools to total depth, which is unknown, the last record being from 3,543 ft.

Tertiary clay, sand and gravel were penetrated from surface to 422 ft., Walloon Coal Measures to 1,114 ft. (with 8 ft. of coal at 764 ft.), Bundamba Group to 2,100 ft., Moolayember Shale to 2,784 ft., Clematis Sandstone to 3,220 ft. then indurated carbonaceous shale and sandstone to 3,543 ft. with conglomerate at 3,441 ft. It is not certain whether the base of the Mesozoics should be placed at 3,220 ft. or at the conglomerate at 3,441 ft. Comparison with cores from C.O.L. No. 1 (Speculation) to the west, suggest that the conglomerate may be pre-Mesozoic.

No gas or oil shows were logged. A little water was found in the Tertiary sediments at 100 ft. and 409 ft., and in the Walloons at 764 ft. Water between 1,976 ft. and 2,800 ft. rose to 18 ft. from surface when tested. Another show was logged at 2,065 ft.

Casing history is not recorded. Cores were taken at selected depths and showed dips of 5° or less to bottom. The only test recorded was the water test at 2,800 ft. The well is used for town supply.

A.R.O. No. 21 (Brigalow)

This well is located on D. Gruhle's property, portion 44, parish of Ewer, approximately 6 miles south-south-west from Brigalow. Surface elevation is 1,040 ft. It was sunk 100 ft. south-west from a water bore which had oil showings at 408 ft.

Drilling commenced on 21st June, 1936, and ceased at 611 ft. on 23rd January, 1937. Percussion tools were used.

Formations penetrated consisted of 178 ft. of clay and sandstone showing oxidation colours, pebbles near the base and also carbonaceous material; followed by grey and carbonaceous shales and coal seams to 611 ft. with sandstone bands and beds between 445 and 468 ft. and calcareous sandstone 522 ft. to 530 ft. The upper 178 ft. is probably Tertiary sediments, the remainder Walloon Coal Measures. Coal seams are recorded at 351 ft. (3 ft.); 423 ft. (3 ft.); 468 ft. (2 ft.); and 485 ft. (1 ft.).

Gas showings are recorded from 348 ft., 421 ft. to 432 ft. and occasionally to 554 ft. No sample was collected. Oil colours occurred from 430 ft. to 563 ft. Water is recorded as salty to 426 ft. and fresh at 452 ft.

A bailing test at 432 ft. with casing seated at 421 ft. gave light oil showings and gas which burnt with a 4 in. flame. No volume was measured. It was intended to shoot the well but on lifting the casing water flooded the hole and the project was abandoned.

Beaudesert Boring Company No. 1 (Beaudesert)

This bore is situated on portion 13, parish of Beaudesert, one mile south-west of Beaudesert township. Surface elevation is approximately 80 ft.

Drilling with percussion tools commenced on 11th April, 1929, and was abandoned at 1,600 ft. in April 1932.

Formations penetrated consist of alluvium to 92 ft. and Walloon Coal Measures to bottom, with a dolerite sill from 300 ft. to 330 ft.

Gas and oil were recorded at frequent intervals, particularly below 1,200 ft., but as small showings only. Gas from 1,420 ft. was analysed as 0·8 per cent. carbon dioxide, 64·5 per cent. methane, 34·7 per cent. inert gas.

Water was found in the alluvium and at 350 ft., 728 ft. and 812 ft. in the Walloon Coal Measures.

Eight inch casing was seated at 348 ft. and 6 in. casing followed the bit. No cementing is recorded. No attempt to test the well is recorded, but as there is no information concerning the last 200 ft. of drilling, a test may have been made.

Bell's Topel Bore No. 1 (Boonah)

This shallow bore was sunk during 1929 on portion 216A, parish of Coochin, one mile west of Dugandan railway station, which is the terminus of the Fassifern branch railway. The bore was drilled to check reports of oily material found in shallow water wells and bores in the immediate vicinity. It penetrated 112 ft. of clay and black and grey shale with some coal, belonging to the Walloon Coal Measures.

Bell's Bore, Boonah

See Boonah Oil Prospecting Co. Ltd. No. 1 (Dugandan).

Bishop's Scout Bores Nos. 1 and 2 (Toorbul)

Two percussion bore holes were sunk in the vicinity of Toorbul Point between 1937 and 1940. The sites were selected by divination. The surface elevation of the sites is not known but would be less than 25 ft. The first was located in portion 6, parish of Toorbul, county of Canning, 8 miles by road from Caboolture. It reached a depth of 188 ft. in sandstone with some shale.

The second borehole was located in portion 26v, parish of Toorbul. The total depth was reported to be 807 ft. After penetrating 55 ft. of clay and gravel of probable post-Tertiary age, the strata consisted of fine to medium grained, slightly calcareous sandstone with some shale, of Mesozoic age. Water was reported at 175 ft. (salt), 300 ft., 465 ft., 484 ft. and 676 ft. Inflammable gas shows were reported at 350 ft. and 484 ft., but these were not confirmed.

Boonah Oil Prospecting Co. Ltd. No. 1 (Dugandan)

This well is situated 2 miles eastwards from Dugandan railway station on subdivision 2, portion 8, parish of Dugandan.

The site was chosen by divination, and oil was predicted at 380 ft. to 390 ft. Records show a depth of 352 ft. at the end of 1929 but no further information is available.

The log shows soil and "billy" to 20 ft., basalt to 152 ft. with 20 ft. of black shale from 111 ft. "Bundamba type" sandstone is logged from 170 ft. to 250 ft. followed by shales with coal from 280 ft. to 292 ft. and from 340 ft. to 350 ft. This latter coal analysed 1·8 per cent. moisture, 28 per cent. volatile matter, 32·3 per cent. fixed carbon and 37·9 per cent. ash which is comparable with Ipswich coal analyses. However, the regional geology suggests that this formation is Walloon, and there is no evidence available to support the suggestion that it may be Ipswich Coal Measures.

There is no record of gas or oil, but spa water is recorded at 111 ft. and brackish water at 345 ft. No other details are on record.

Blume's Bore

See Malta Oil Company No. 1 (Nive River).

Brigalow

See A.R.O. No. 21 (Brigalow).

British Australasian Oil Syndicate No. 1 (Gatton)

This well is situated 4 chains from the south-west corner of subdivision 8, portion 35, parish of Tenthill, 6 miles south-west from Gatton; surface elevation is approximately 400 ft. The well is also referred to as Robinson's Bore. The site was selected by divination.

Drilling commenced on 6th May, 1931, and reached a depth of 1,082 ft. on 16th January, 1933.

Formations penetrated consisted of Tertiary clay and hard brown sandstone to 40 ft., Walloon Coal Measures (calcareous sandy mudstone and sandstone) to 671 ft., Bundamba Group (conglomeratic at the base) to 996 ft., and Ipswich Coal Measures (shale, grit and carbonaceous shale), to bottom at 1,082 ft.

Gas was recorded at intervals between 519 ft. and 1,080 ft. but no sample was collected. Analyses showed the presence of thick black oil in sludge samples from 930 ft. and 945 ft., but the quantity of oil was very small.

Water was recorded at 40 ft., 944 ft., 979 ft. with gas and oil specks and at 1,008 ft.

Several bailing tests were made by seating the casing as the drilling progressed but no production was obtained.

A surface string of 8 in. casing was cemented at 60 ft. All other casing was removed before abandonment.

Brown's Scout Bores Nos. 1 and 2 (Chinchilla)

Two shallow holes were sunk by E. T. Brown in 1929 on portion 22, parish of Ewer, 10 miles south from Chinchilla, to investigate the possibility of petroleum in the area. Gas under pressure had been reported from a water bore on the same portion in 1916.

The first well struck gas in small quantity at 172 ft. and the second, 30 ft. away, proved a better gas show. (Analyses Table III).

Tertiary sediments rest on Walloon Coal Measures at approximately 160 ft.

Further operations were suspended because the quantity of gas was not up to expectations. Analysis showed no ethane content.

Builder's Ltd. Scout Bores (Roma)

Builders Ltd. drilled 158 shallow structural and stratigraphic bores in the Roma area in 1928. The maximum depth was less than 500 ft., and aggregate footage was 35,000 ft.

Although several anticlinal structures were found, no deep test was made. Groups of closely spaced bore holes revealed the lenticularity of the Cretaceous sediments.

Cockatoo No. 2 Bore

See Providence Oil Pty. Ltd. No. 1 (Twin Hills).

Condamine Oil Limited No. 1 (Speculation)

This well is located 24 miles north-east of Chinchilla, at lat. 26° 28′ S., long. 150° 44′ E. Drilling began with a percussion plant on 5th August, 1948. A string of tools was lost in the hole, at 2,202 ft. on 6th April, 1953. After by-passing this, the well was deepened to 2,332 ft. in the period up to 28th August, 1957. The rig was subsequently converted to rotary operation, and reaming was carried out until October 1959, when operations were temporarily suspended; total depth remained 2,332 ft.

The strata penetrated were:

0– 250 ft.	Walloon Coal Measures
250–1,041 ft.	Bundamba Group
1,041–1,555 ft.	Moolayember Shale
1,555–1,765 ft.	Clematis Sandstone
1,765–2,332 ft.	indurated conglomerate

The indurated conglomerate met from 1,765 ft. to total depth, consists largely of fragments of volcanic rocks.

The driller reported a gas showing at a depth of 2,200 ft.; this has not been confirmed.

Consolidated Roma Oil Ltd. Scout Bores Nos. 1-4 (Brigalow)

Four shallow scout holes were drilled in 1928 on the north-western outskirts of Brigalow township, to determine the structure of the area about Beutel's water bore, in portion 48, parish of Earle, in which gas was found.

The bores showed a north-south fold, and a deep test site was selected but not drilled. Formations penetrated were 60 ft.–70 ft. of Tertiary sand and grit followed by Walloon Coal Measures. Coal seams up to 6 ft. thick are recorded at 172 ft. maximum depth.

Cooper's No. 1 Well (Lowood)

This well is located on portion 376, parish of Walloon, 4½ miles bearing 165° from Lowood. The site was selected by divination. Surface elevation is approximately 600 ft.

Drilling commenced in July 1920, and reached 1,265 ft. on 9th July, 1923. A percussion plant was used.

Basalt was penetrated to 31 ft., Bundamba Group to 365 ft. and Ipswich Coal Measures to total depth 1,265 ft. Black shale and oil shale were logged frequently but the only coal reported was at 886 ft.

Gas and oil showings were logged at numerous depths in the Ipswich Coal Measures. Gases from 800 ft. and 950 ft. were non-petroliferous. A trace of oil was found in sludge from 900 ft. (Table IV).

Water was logged at 305 ft. and 536 ft. A water analysis was made on water collected in 1935 with casing at 900 ft. but the depth of the aquifer cannot be determined (Table V).

Records do not show any formation test results but it is assumed that the showings were too small to warrant testing.

Currier's Bore

See Salt Domes Oil Syndicate No. 2 (Boonah).

Delhi-Frome-Santos Innamincka No. 1

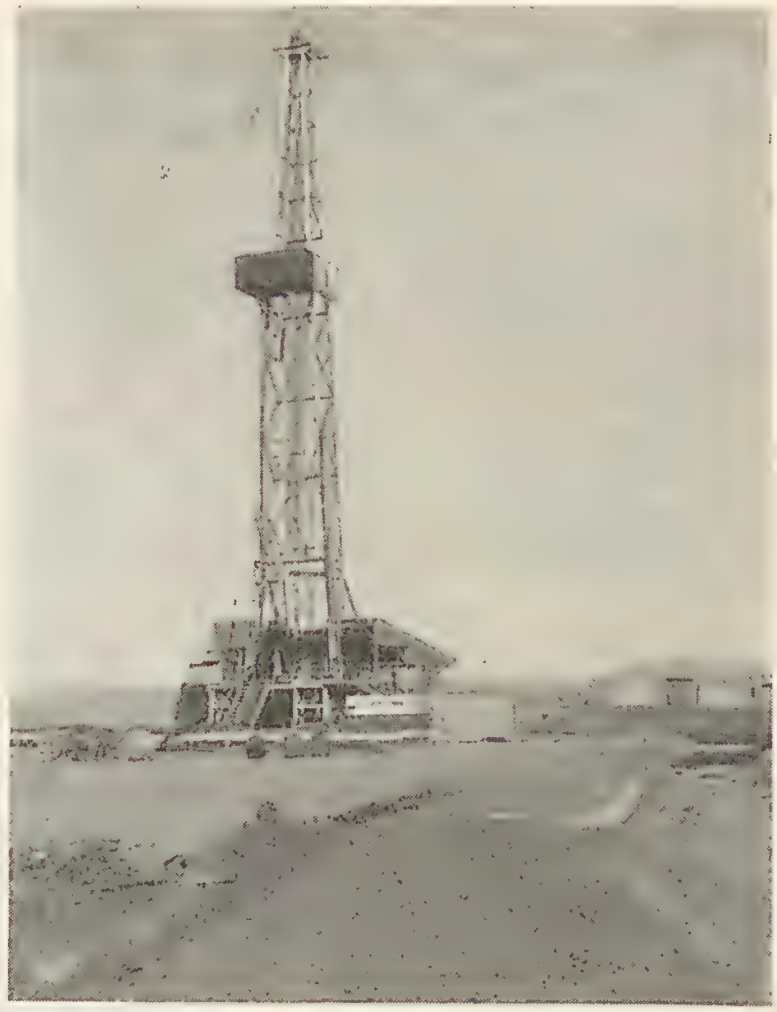
This well was drilled at lat. 27° 29′ 21·3″ S., long. 140° 55′ 7·7″ E., in South Australia, adjacent to the Queensland border, to test a large anticlinal structure (Innamincka Dome) defined by surface geological mapping and seismic methods. The three partners in the venture were Delhi Australian Petroleum Ltd., Frome–Broken Hill Co. Pty. Ltd. and Santos Ltd. The drilling was subsidised by the Commonwealth Government under the *Petroleum Search Subsidy Act,* 1957-58. The drilling contractor was Delta Drilling Co., and the rig a National Ideal 130. Rotary table elevation was 412·7 ft., and surface elevation 401·7 ft. Drilling commenced on 28th March, 1959, and was completed at a total depth of 12,637 ft. on 16th November, 1959. The well was completed as an artesian water well on 27th November, 1959.

Delhi-Frome-Santos Betoota No. 1

This well was drilled at lat. 25° 42′ 30″ S., long. 140° 49′ 51″ E., to test a large anticlinal structure (Betoota structure), defined by surface geological mapping and seismic methods. The drilling was subsidised by the Commonwealth Government under the *Petroleum Search Subsidy Act,* 1957-58. Surface elevation was approximately 345 ft. The drilling contractor was Delta Drilling Co., and the rig a National "Ideal" 130. Drilling commenced on 22nd December, 1959, and progress depth at midnight on 31st December, 1959, was 1,201 ft.

Delta Oil N.L. Nos. 1 and 2 (Barcaldine) (P.P.P. 148)

Two wells were sunk by Delta Oil N.L., some 14 miles bearing 105° from Barcaldine, to check the report of oil showings in an old water bore. The approximate location of the bores is lat. 23° 37′ S., long. 145° 30′ E., but their relative position is not recorded. Surface elevation is approximately 950 ft.



Delta Drilling Co.'s National 130 rig drilling D.F.S. Betoota No. 1, S. W. Queensland.

Well No. 1 was commenced on 7th January, 1929, and reached 675 ft.; well No. 2 was commenced on 10th March, 1930, and operations ceased on 30th May, 1930, at 420 ft., with the exhaustion of the Company's finances.

Formations penetrated were Tertiary clay and gravel to 46 ft., marine Cretaceous to 432 ft., Blythesdale Group to 528 ft., and brown and blue shale with coal and some sandstone (probably Walloon Coal Measures) to 675 ft. No. 2 well reached the marine Cretaceous at 70 ft., but did not reach the top of the Blythesdale Group.

No gas was logged. Wax was reported at 435 ft. and drillings and cores from 634 ft. to 675 ft. gave traces of free oil on analysis.

Water was logged as:—good supply at 46 ft.; 432 ft. and 485 ft., large artesian supplies; and 615 ft. to bottom, salty water.

Drillers Ltd.

See O.S.L. Nos. 1–3.

East Roma Oilfield No. 1

See A.R.O. No. 11 (Blythdale).

Fagen's Bore

See Salt Domes Oil Syndicate No. 1 (Boonah).

Frome-Broken Hill Co. Pty. Ltd. No. 1 (Wyaaba)

This well is located 90 miles north-north-east of Normanton at lat. 16° 29′ 30″ S., long. 141° 37′ 22″ E. The rotary table elevation was 40·5 ft. above mean sea level, 5 ft. above ground level. The well was sited in a gravity trough with the object of finding the thickness and nature of the sedimentary section. The drilling was a joint venture between Frome-Broken Hill, and Associated Australian Oilfields N.L.—Associated Freney Oil Fields N.L., who held adjacent Authorities to Prospect.

The well was spudded in on 19th October, 1957, and reached final depth, 2,822 ft., on 15th November, 1957. The rig used was a Sullivan 300A, operated by Mines Administration Pty. Ltd. An 11 in. hole was drilled to 175 ft., then 8⅝ in. J55 x 36 lb. casing was run to 169 ft., and cemented to the surface. A 5⅝ in. open hole was drilled from 175 ft. to total depth, 2,822 ft. The well was abandoned as a dry hole by placing cement plugs from 2,640 to 2,610 ft., 180 to 160 ft., and from 20 ft. to the surface. Five cores were cut during the drilling. The hole was logged electrically to total depth, by the Bureau of Mineral Resources with a Widco single electrode unit. Self potential and point resistivity curves were recorded.

The strata penetrated in the well may be divided into the following units:—

Surface–120 ft.	Alluvium, etc.	Quaternary ?
120– 335 ft.	Lynd Formation equivalent	Tertiary
335–1,820 ft.	Normanton Formation equivalent	Cretaceous
1,820–2,623 ft.	Blackdown Formation equivalent	
2,623–2,763 ft.	Wrotham Park Sandstone equivalent	
2,763–2,822 ft.	Basement	Pre-Cretaceous

The section above 105 ft. consists of fine to coarse very friable quartz sandstone, and is tentatively correlated as Quaternary alluvium.

The Lynd Formation equivalents consist of fine to coarse grained quartz sandstone, with interbedded gravel and conglomerate. The upper 30 ft. consist entirely of gravel and conglomerate. No fossils were present in this formation and the beds are of freshwater origin.

The Normanton Formation equivalent is dominantly argillaceous. The top of the unit is characterised by a 10 ft. bed of red-brown sandstone, underlain by kaolinite. This is thought to represent a residual lateritic profile developed before deposition of the overlying Lynd Formation. Throughout the section interbeds of sandstone and siltstone are common, and are up to 40 ft. in thickness. Generally, the formation is composed of silty shale, with minor amounts of calcareous siltstone, calcareous sandstone, and cone-in-cone limestone. Glauconitic sandstone and siltstone are common below 1,165 ft.

Microfossils were first recorded from 900 ft. On this basis the section 335 to 805 ft. has been correlated with the fresh-water Winton Formation, but as there is no record of Upper Cretaceous fresh-water sediments in the Carpentaria Sub-Basin, it seems better to include this interval 335 ft–805 ft. in the Normanton Formation equivalent.

From 1,820 ft. to 2,627 ft. the section consists largely of shale, with interbeds of glauconitic siltstone and sandstone. This unit has been correlated with the Blackdown Formation, the upper limit in this well being based on breaks in the self-potential and resistivity curves. This can be correlated with a similar horizon in A.A.O. No. 8 (Karumba) well, but it is not certain that this corresponds to the junction of the Normanton and Blackdown Formations at their type localities. Micropalaeontological studies by the Bureau of Mineral Resources have indicated a lower Cretaceous age for the interval 900 ft.–2,700 ft., with an age of "probably Albian" (i.e. Tambo or Normanton equivalent) from 1,157 to 2,200 ft.

The Wrotham Park Sandstone equivalent from 2,627 ft. to 2,763 ft., consists largely of glauconitic sandstone, with a few interbeds of shale. A few carbonised plant remains were found in Core No. 4, 2,627–2,637 ft.

The basement rock consists of sheared andesine-chlorite-quartz greenstone, derived from gabbro.

There were no shows of oil or gas in the well. No formation tests were made.

Glenalvon Mineral Oil Co. Scout Bores (Rosewood)

A number of shallow boreholes were drilled in this area but records of Nos. 1, 2 and 7 only are available. Nos. 1 and 2 are situated in portion 10, parish of Forbes, county of Churchill (lat. 27° 45′ S., long. 150° 34′ E.) and were drilled in 1907. No 7 is in subdivision 32 N7, parish of Forbes, 10 chains south-east of No. 1, and was drilled in 1927.

No. 1 bore (elevation 350 ft.) was drilled to 120 ft. in light coloured shale. Gas was encountered at 105 ft. No. 2 bore (elevation 300 ft.) was drilled through shale, sandstone and some coal (Walloon Coal Measures) to a probable depth of 660 ft. No. 7 bore (elevation 300 ft.) was drilled to a depth of 170 ft. in sandstone and yellow shale. Gas was encountered from 117 ft. to 170 ft. and consisted of 57 per cent. methane, 40 per cent. inert gas and 0·5 per cent. carbon dioxide. (Table III.) Several other bores in the vicinity are known to have encountered gas.

Golden Chance Syndicate No. 1 (Helidon)

The site of this well was selected by divination on the boundary between portions 9V and 10V, parish of Taylor, county of Churchill, 5 miles east from Toowoomba. Surface elevation is approximately 900 ft.

Drilling commenced on 7th August, 1937, and ceased on 31st August, 1938, at 858 ft., the limit of the light percussion plant used.

The well penetrated only Walloon Coal Measures, consisting of sandstone, shale and calcareous shale, without coal seams.

Gas was recorded at 782 ft. in black shale, but no sample was collected. Water is recorded as being difficult to shut off but no depth is recorded. No tests were made.

Henzell's Scout Bores (Stradbroke Island)

In 1930, R. Henzell drilled two shallow scout bores near the pumping station dam, 1½ miles north of Dunwich on Stradbroke Island, to try to locate the source of oil films seen on the waters of the dam. No. 1 bore was sunk ½ chain east of the dam, to a depth of 56 ft. No. 2 was sunk 9 chains south-east of the dam, and at an elevation of 30 ft. above it, to an unknown depth, in excess of 63 ft. The bores penetrated only dune sand and swamp deposits. No show of oil was met. L. C. Ball concluded that the oil showing in the dam was due to contamination from power plant dumps.

Hodinotte's Oil Bores (Tambo)

These bores were drilled in 1922 on Macfarlane Downs at the head of Cone Creek, 20 miles west of Tambo, lat. 24° 52′ S.; long. 145° 54′ E. The surface elevation is about 1,300 ft.

There was one bore 1,200 ft. deep, and three very shallow holes nearby.

The bores penetrated marine Cretaceous rocks. Signs and odours of oil were found, possibly caused by the pulverising of oil shale. Saline water only was encountered.

Humber Barrier Reef Oils Pty. Ltd. No. 1 (Wreck Island) (Fig. 10)

This stratigraphic well was drilled at lat. 23° 20′ S., long. 151° 57′ 30″ E., on Wreck Island, about 65 miles north-east of Gladstone. The drilling was subsidised by the Commonwealth Government, under the *Petroleum Search Subsidy Act*, 1957-1958. The drillers were Mines Administration Pty. Ltd., and the rig was a National T32. Rotary table elevation was 22 ft. above mean low tide and 9 ft. above surface. The well was spudded-in on 7th May, 1959, reached final depth of 1,898 ft. on 12th June, 1959, and was plugged and abandoned as a dry hole on 14th June, 1959.

A 12¼ in. hole was drilled to 493 ft. Due to lost circulation, cuttings had to be bailed from the hole. The 12¼ in. pilot hole was opened to 17½ in. and 13⅜ in. J55 x 54·5 lb. STC casing was run to 480 ft. A 12¼ in. hole was drilled to 1,170 ft., and 9⅝ in. J55 x 40 lb. STC casing was run and cemented to 1,110 ft. An 8½ in. hole was then drilled to total depth, 1,898 ft. Fourteen cores were cut. The hole was logged to total depth with a Failing Logmaster, giving S.P., point, 16 in. and 63 in. resistivity, and gamma ray curves. The section penetrated was divided thus:

0– 310 ft.	Recent R1	calcarenite
310– 398 ft.	Recent R2	limestone
398– 530 ft.	Pleistocene Pl 1	quartz sandstone
530– 735 ft.	U. Pliocene P1	limestone
735– 945 ft.	L. Pliocene P2	calcarenite
945–1,025 ft.	U-M. Miocene M1	calcarenite
1,025–1,110 ft.	U-M. Miocene M2	sandstone
1,110–1,385 ft.	L. Miocene M3	calcarenite
1,385–1,540 ft.	L. Miocene M4	siltstone
1,540–1,780 ft.	L. Miocene M5	sandstone
1,780–1,795 ft.	L. Miocene M6	coarse sandstone
1,795–1,898 ft.	Basement	dacitic lapilli tuff

The age determinations are tentative only. The entire sedimentary section is marine and dominantly calcareous. The units R1 and R2 are composed of reef detritus. Pl1 is composed mainly of terrigenous material. P1, P2, M1, M2 and M3 are composed essentially of reef detritus, although minor amounts of terrigenous material are present. M4, M5 and M6 are composed dominantly of terrigenous material. The basement rock was named dacitic intrusion breccia by the Bureau of Mineral Resources, and dacitic lapilli tuff by the Geological Survey of Queensland.

No shows of oil or gas were noted, and no drill stem tests were made. Three deviation surveys were made; maximum deviation was ½° at 1,580 ft. The well was abandoned by placing cement plugs from 1,160 ft. to 1,060 ft., and from 50 ft. to surface.

Hutton Creek

See Oil Search Ltd. No. 2 (Hutton Creek).

Interstate Mines and Petroleum No. 1

See A.R.O. No. 13 (Euthulla).

Isis Petroleum Prospecting Syndicate Bores (Elliott River)

This syndicate sank one well to 600 ft. and two very shallow wells. Drilling was done with percussion tools, during 1923.

The 600 ft. well is situated on the southern boundary of portion 1,131 near the division between 21v and 19v, parish of Bundaberg, 10 miles south from Bundaberg township. Surface elevation is approximately 55 ft.

Tertiary clay and soft water-bearing sandstone, with 10 ft. of lignite at 60 ft., were penetrated to 170 ft., and Burrum Coal Measures (Cretaceous) to 600 ft. No coal was reported.

Gas was recorded at 325 ft., 395 ft.–405 ft. and 590 ft.–600 ft. For analyses see Appendix I.

Kayenta Oil and Coal Syndicate

See A.R.O. No. 9 (Gunnewin).

Landar Oilfields (Aust.) Ltd. No. 1 (Orallo)

This well is situated near the south-west corner of portion 26, parish of Orallo, 28 miles north-west from Roma. Surface elevation is 1,360 ft.

Drilling with rotary tools commenced on 15th November, 1923, and reached a depth of 2,644 ft. on 21st June, 1924. The well was temporarily abandoned on 31st July, 1924, when 2,515 ft. 6 in. of drill pipe became stuck in the hole.

The graphic log is difficult to interpret but the formation boundaries are at approximately the following depths: Blythesdale Group from surface to 320 ft., Walloon Coal Measures to 1,290 ft., Bundamba Group to 1,960 ft. and Moolayember Shale to total depth 2,644 ft. On the evidence of L.O.A.L. No. 3 well drilled nearby, granite basement is at or near this depth.

Gas and oil shows were logged at frequent intervals in the Walloon Coal Measures and from 1,800 ft. to bottom. Samples of sludge and scum collected by bailing at 2,640 ft. gave some natural oil (Table IV), and gas analysed as: air 20 per cent., inert gas 80 per cent. Later samples from near bottom gave 65·6–80 per cent. hydrogen, 2·3–3·7 per cent. methane and the remainder inert gases. Hydrogen is not normally a constituent of natural gas and the Government Chemical Laboratory supported the suggestion that it was formed by the action of the cement-contaminated water on the aluminium bailer.

The casing state of the well is very doubtful, because of cutting and parting strings and cementing liners in attempts to test the well. Fifteen and a half inch casing was cemented at 220 ft., and 10 in. casing was cemented at 1,238 ft., without effecting a seal.

In 1925, after the drilling of L.O.A.L. No. 2 (Orallo), L.O.A.L. No. 1 was reopened and the drill pipe recovered. A reamer then became stuck and was shot off at about 2,100 ft.; when the 10 in. casing was pulled to clear the hole, it parted at 1,355 ft. Eight inch casing was then run through the 10 in. sleeve to 2,160 ft. and cemented. The plug was drilled out and the hole cleaned to bottom with a 7½ in. (?) bit, the hole diameter being about 9 in. Bailing reduced the fluid level to about 750 ft. but inflow prevented further lowering. Some gas was obtained by thief bailing at 1,200 ft.

As the objective was to test shows between 2,160 ft. and 2,260 ft., a plug was set at 2,260 ft. Bailing to 887 ft. revealed some gas and inflow of saline water contaminated with cement.

The hole was plugged again at 2,260 ft. and was bailed to 1,100 ft., when influx prevented further lowering of the fluid level.

The operators were satisfied that the cement round the casing and at the plug was water-tight and decided to place another plug at 2,180 ft.

Apparently this plug was incorrectly measured and filled the hole to 2,121 ft., that is, above the 8 in. casing.

No further records are available, and presumably the hole was abandoned in this condition.

L.O.A.L. No. 2 (Orallo)

This well is situated 112 chains north-east of L.O.A.L. No. 1 (Orallo), near the middle of the northern boundary of portion 26, parish of Orallo. Surface elevation is 1,440 ft.

Drilling commenced on 23rd October, 1924, with rotary tools; final depth of 2,839 ft. was reached on 9th April, 1925.

Blythesdale Group was penetrated to 280 ft., Walloon Coal Measures to 1,220 ft., Bundamba Group to 1,805 ft. and Moolayember Shale to bottom (2,839 ft.).

Gas was logged at 760 ft., 2,180 ft.–2,208 ft., and an oil showing was logged at 760 ft.

Water was met at 230 ft., 460 ft., 1,250 ft. and 1,460 ft. After total depth was reached, the drilling mud was displaced by water and the well tested to 200 gallons per day. Water level was 400 ft. It was stated that with air lift at 1,250 ft., the well would produce one million gallons per day.

No coring or testing appears on record. The management abandoned the hole because it considered that the lithology was unsuitable for oil accumulation.

The only casing used was 174 ft. of 18 in. diam. surface string. The well was covered on abandonment.

L.O.A.L. No. 3 (Orallo)

This well is situated 236 ft. east and 27 ft. south from L.O.A.L. No. 1 (Orallo). Surface elevation is 1,363 ft.

The expenses were subsidised by the Commonwealth Government to check showings reported in the original well, which were not thoroughly tested because of various mishaps to equipment and materials.

Drilling commenced on 13th May, 1926, and ceased at 2,672 ft. in October 1926.

Tertiary clay and gravel were penetrated to 160 ft. To 375 ft., the drill met shale with some sandstone, which are correlated with Blythesdale Group, though the lithology logged is not normal for this Group and it is possible that most of the Group was eroded before deposition of the Tertiary sediments. Walloon Coal Measures were met to 1,280 ft. and Bundamba Group to 1,960 ft. Sandstones and brown shales correlated with the Moolayember Shale rest on granite at 2,659 ft.

Gas and oil were logged frequently from 1,900 ft. down. Gas collected from the mud stream and considered to originate at 2,241 ft., was analysed as 91 per cent. inert gas. Water was recorded at 210 ft. and doubtfully at 1,890 ft.

Cores were taken at intervals from 1,908 ft. to bottom. Dips of 20° were recorded at 1,931 ft., 2,350 ft. and 2,573 ft.

Eighty-three feet of 18 in. surface casing only, was used in the well. No testing was recorded before the well was sealed and abandoned.

When drilling at 2,262 ft. the drilling mud had a specific gravity of 1·24 and driller's reports show "balling" of the bit in the lower part of the hole. Mud of this density would be more than sufficient to hold back gas at pressures comparable with those in the Roma area.

L.O.A.L. No. 4 (Hospital Hill)

This well is situated near the north-east corner of portion 178, parish of Roma, between the Hospital Hill bores and the railway line. Surface elevation is 1,018 ft.

Drilling, with rotary tools, commenced on 12th April, 1929, and reached 4,158 ft. on 24th September, 1929.

Roma Formation was penetrated from surface to 760 ft.; Blythesdale Group to 1,390 ft.; Walloon Coal Measures to 2,680 ft.; Bundamba Group to 3,265 ft. and Moolayember Shale to 3,838 ft., where metamorphic bedrock was entered.

Gas was reported at 760 ft., 1,000 ft. (small), 1,725 ft., 1,938 ft., 3,548 ft., 3,691 ft. (strong) and 3,895 ft. (Table III). Oil signs were recorded at 2,800 ft. and wax at 2,890 ft. Positive chloroform tests were reported at 3,500 ft. (Table IV).

A gas sample collected two months after testing the well contained 29·2 per cent. ethane and higher hydrocarbons. A sludge collected at 758 ft. gave 0·4 per cent. thick mineral oil.

Water was logged at 410 ft., 790 ft., 992 ft., 1,335 ft., 1,580 ft., 3,215 ft.–3,250 ft. and 3,410 ft. Water flowed between the 12¼ in. casing set at 1,302 ft. and the 8⅝ in. casing set at 3,654 ft.

Cores were taken from 3,420 ft. to bottom. The Mesozoic sediments showed dips of 10° and the metamorphics 60° to 70°.

The hole below the 8⅝ in. casing was bailed almost dry, but only showings of gas and oil were obtained, with slight water influx. The well was shut down for two months during which period some gas entered the hole, but in no quantity.

Longreach Oil Ltd.

During 1954-55 eight scout bores were drilled for Longreach Oil Ltd. by J. and MacD. Royle Pty. Ltd., in the Balmoral, Lochinvar and Delta North areas, east of Longreach. The object was to obtain stratigraphic and structural information. Depth ranged from 25 to 602 ft. No shows of oil or gas were recorded.

From 1954 to 1959, six test wells were drilled for Longreach Oil Ltd.: one at Cleeve, three at Longreach, and two at Balmoral.

L.O.L. No. 1 (Cleeve) (Fig. 11)

This well is located at lat. 23° 25′ 40″ S., long. 144° 23′ 30″ E., 8¾ miles east of Longreach. Surface elevation is 700 ft., and rotary table elevation was 712 ft. The well was drilled by Oil Drilling and Exploration Ltd., with a National T32 rig, and was designed to test the Cretaceous rocks in the area. Drilling began on 17th December, 1954, and was completed on 13th January, 1955, at a depth of 3,068 ft.

The following formations were penetrated:

0–1,550 ft.	Tambo Formation
1,550–2,097 ft.	Roma Formation
2,097–2,284 ft.	Upper Blythesdale Group
2,284–2,412 ft.	Lower Blythesdale Group
2,412–3,056 ft.	Walloon Coal Measures
3,056–3,068 ft.	Basement—weathered granite

The Tambo and Roma Formations consist mainly of dark shale and sandy shale with some siltstone, sandstone and limestone. The division between the two formations is placed at 1,550 ft. The Blythesdale Group, from 2,097 ft. to 2,412 ft. consists of fine to coarse sandstone, with some dark shale. The Walloon Coal Measures extend from 2,412 ft. to 3,056 ft. and consist of hard black shale and fine to coarse grained sandstone, with some coal and limestone. Weathered granite basement was penetrated from 3,056 ft. to total depth 3,068 ft.

Artesian aquifers were met between 2,097 ft. and 2,145 ft., 2,222 ft. and 2,388 ft. and 2,798 ft. and 2,821 ft.

The only petroleum manifestation in this well was a faint oil staining of grains in sandstone at 2,946 ft. to 2,956 ft. The oil-bearing rocks met in the lower part of the L.O.W. No. 1 bore, were not found in this well, and apparently had wedged out against a basement rise. In L.O.L. No. 1, the basement is 289 ft. higher structurally than in L.O.W. No. 1 bore.

L.O.L. No. 2 (Longreach) (Fig. 11)

This well is located on R. 47, Town of Longreach. Surface elevation is 628 ft. and rotary table elevation, from which all depth measurements were made, was 639 ft.

The well was drilled by Oil Drilling and Exploration Ltd. using a National T32 rotary plant. Drilling commenced on the 25th January, 1955, and total depth of 3,224 ft. was reached on the 28th February, 1955.

The following strata were penetrated:

Surface–1,590 ft.	Tambo Formation
1,590–2,300 ft.	Roma Formation
2,300–2,445 ft.	Upper Blythesdale Group
2,445–2,615 ft.	Lower Blythesdale Group
2,615–3,191 ft.	Walloon Coal Measures
3,191–3,219 ft.	? Permian or Triassic
3,219–3,224 ft.	Basement—weathered granite

Marine Cretaceous beds of the Tambo and Roma Formations from surface to 2,300 ft. consist of black shale, with minor sandstone, siltstone and limestone. Blythesdale Group sediments consist of grey sandstone and grey- to dark-grey shale. This group is separated into upper and lower divisions, partly on electric log data. Walloon Coal Measures from 2,615 ft. to 3,191 ft. consist of compact sandstone, argillaceous sandstone and black shale. A coal sample from 3,185 ft. was examined at the Geological Survey of Queensland, and found to contain a Jurassic spore assemblage. The sequence contains porous sandstone with dark shale bands from 2,445 ft. to 2,615 ft. and porous sandstone from 2,869 ft. to 2,910 ft. Brittle dark shale and argillaceous sandstone with little porosity occur from 2,615 ft. to 2,869 ft. and from 2,910 ft. to 3,191 ft. A zone of calcite veins occurs at 3,178 ft. The basal members, 3,184 ft. to 3,191 ft. consist of sandy shale and coarse pebbly sandstone with a four inch coaly band at 3,185 ft.

Sandy chert from 3,191 ft. to 3,198 ft. rests on coarse to conglomeratic quartz sandstone with kaolin matrix; this passes into decomposed granite at 3,219 ft. The age of this basal sequence is indefinite but is possibly Lower Triassic or Upper Permian. The

absence of the sandy chert in two wells subsequently drilled close to this hole, indicates that the chert is of local occurrence.

Water bearing beds, as shown by the electric log, occur in the upper section of the Blythesdale Group at 2,300 ft.–2,310 ft. and 2,395 ft.–2,410 ft., but the main aquifer beds are in the Jurassic between 2,445 ft. and 2,615 ft., and 2,860 ft., and 2,900 ft.

On completion of the hole the interval 2,860 ft.–2,900 ft. was tested for two hours, during which time 1,440 ft. of mud and 1,455 ft. of water without any indications of oil or gas were recovered. In the chert at 3,191 ft., fracture planes had a waxy lustre and gave a faint fluorescence, possibly due to mineral wax; no other oil indications were noted. The 50 ft. of petroliferous rocks encountered in L.O.W. No. 1 and Longreach No. 2 water bore between the chert horizon and basement were, in this well, only 21 ft. thick, indicating a wedge-out against a rising basement.

Cement plugs were set at 2,900 ft. to 2,975 ft., 2,170 ft.–2,200 ft. and from 20 ft. to surface and the hole abandoned.

L.O.L. No. 3 (Longreach) (Fig. 11)

This well is located 225 ft. west and 40 ft. south from the north-east corner of R. 49, Town of Longreach. Surface elevation is 618 ft. and rotary table elevation was 629 ft.

The well was drilled by Oil Drilling and Exploration Ltd. using a National T20 rotary plant. Drilling commenced on the 15th March, 1955, and was completed on the 13th April, 1955, at a depth of 3,490 ft.

Cretaceous beds were penetrated from surface to 2,545 ft. These consist of marine shale from surface to 2,400 ft. followed by black shale with sandy bands and streaks to 2,545 ft. A 5 ft. water bed occurs at 2,400 ft. On the basis of electric logging, the base of the Tambo Formation is placed at 1,690 ft., the base of the Roma Formation at 2,400 ft. and the upper section of the Blythesdale Group at 2,545 ft. Between this depth and the decomposed granite basement at 3,404 ft., the rocks are of Jurassic age. Sandstone occurring between 2,545 ft. and 2,700 ft. is indicated by the electric log to be water-bearing and is considered to be equivalent to the lower section of the Blythesdale Group. Below this is a sequence of shale and sandstone, with a porous sandstone horizon between 2,964 ft. and 3,009 ft. This sandstone aquifer is equivalent to the sandstone between 2,860 ft. and 2,900 ft. in L.O.L. No. 2. Below this sand, the sequence is thicker than in L.O.L. No. 2 and the basal members are coarser; is it possible that these rocks may be lateral equivalents of the Bundamba Group.

The conclusions reached were that the sedimentary sequence thickens to the west, and is of Jurassic age, and that there was no evidence to suggest the presence of older sediments.

No oil or gas indications were noted.

L.O.L. No. 4 (Longreach) (Fig. 11)

This well is located near the north-west corner of sub-division 1, allotment 2, section 1, Town of Longreach, 1,200 ft. bearing 233° true from L.O.L. No. 2 well. Surface elevation is 619 ft. and rotary table elevation, from which all depths were measured, was 630 ft.

Drilling was commenced on the 22nd April, 1955, by Oil Drilling and Exploration Ltd. with a National T20 rotary plant, and completed on the 19th May, 1955, at a depth of 3,277 ft.

No rock samples were described from the top 2,000 ft. because of the proximity to earlier wells. Below this depth marine Cretaceous shale was penetrated to 2,332 ft. Probable marine sandstone, buff granular limestone and black shale with sandy streaks were penetrated to 2,474 ft. Water-bearing sands occur in this interval, but the main aquifers were met below 2,474 ft. On the basis of electric logging, the base of the Tambo Formation is placed at 1,650 ft., the base of the Roma Formation at 2,332 ft., and the base of the upper part of the Blythesdale Group at 2,474 ft. Coarse sandstone, with black to coaly shale and some limestone, between 2,474 ft. and 2,638 ft. are considered to be of Jurassic age and are placed in the lower part of the Blythesdale Group.

The sequence to granite at 3,275 ft. is of Jurassic age. Spore examination of coal samples from 3,237 ft. shows it to be comparable to the Walloon Coal Measures at Rosewood. The sequence consists of fine micaceous sandstone and dark shale becoming coaly towards the base.

Water beds are indicated at 2,332 ft., between 2,450 ft. and 2,560 ft. and between 2,895 ft. and 2,945 ft. A drill stem test over the interval 3,204 ft. to bottom recovered water, which rose 2,150 ft. in the drill pipe in 12 hours. No sample was taken, but the electric log suggests that the water is slightly saline.

Petroliferous indications were obtained over several sections. Thin argillaceous sandstone bands at 3,170 ft. and 3,174 ft. gave petroliferous odours when freshly broken. Seven feet of core recovered from the interval 3,215 ft. to 3,225 ft., gave fluorescence in several places. The core consisted of coarse to pebbly sandstone with clay cement, some of which was stained brown and gave the fluorescence. Core recovered from 3,245 ft. to 3,249 ft. consisted of medium grained, porous to argillaceous sandstone, showing dark brown oil staining and having faint odours and fluorescence.

A five hour test of the interval 3,204 ft.–3,237 ft., yielded 155 linear feet of water without sign of oil or gas. A twelve hour test of the interval 3,204 ft.–3,237 ft. yielded 2,150 linear feet of water, very slightly oil cut. These tests show that the sand at 3,245 ft. contains water, with some oil and no gas. Swabbing would probably have induced

inflow of more oil, but the small thickness and poor porosity of the reservoir rock preclude the possibility of significant accumulations.

L.O.L. No. 4 was located 600 ft. away from Longreach water bore and L.O.W. No. 1 well both of which showed promising manifestations of oil and gas. Although favourably located structurally in relation to these wells, it failed to give equivalent manifestations. The conclusion was reached that the Longreach area, in the immediate vicinity of the wells, is unfavourable for commercial accumulation of oil.

Cement plugs were set at 3,277 ft. to 3,257 ft., 2,320 ft. to 2,300 ft. and 20 ft. to surface, and the hole abandoned.

L.O.L. No. 5 (Balmoral)

This well is situated 16 miles bearing 34° from Ilfracombe, at lat. 23° 18′ S., long 144° 39′ E. Surface elevation is 714 ft., and height of casing head was 1 ft. The well was drilled to test the Lower Cretaceous beds on a gentle anticlinal structure, the presence of which was deduced from water-bore data. The drillers were Godfrey Bros., and the rig an Hydromaster 1500 percussion unit. Drilling began on 1st March, 1958, total depth of 1,367 ft. was reached on 31st May, 1958, and the well was plugged and abandoned on 5th June, 1958. Eight inch casing was cemented to surface at 203 ft.; 6 in. casing was used as a following string, and withdrawn after total depth was reached. The well penetrated calcareous mudstone, calcareous shale, limestone and sandstone (equivalent Tambo and Roma Formations?) to 1,308 ft., and sandstone, mudstone and shale (equivalent Blythesdale Group?) from 1,308 ft. to total depth, 1,367 ft. No trace of oil or gas was found. No water was met to 1,308 ft. A flow estimated at 7,000 gallons per day was met in the sandstone from 1,308 ft. to 1,335 ft., taken as the top of the Blythesdale Group. The well was concluded to be off structure, on the north-eastern limb.

L.O.L. No. 6 (Balmoral)

This well is situated at lat. 23° 18′ S., long. 144° 38′ E., 3,000 ft. bearing 235° magnetic from L.O.L. No. 5 well. It was drilled with the same aim as L.O.L. No. 5, that is, to test a gentle anticlinal structure deduced from logs of surrounding water bores. The drillers were Godfrey Bros. and the rig an Hydromaster 1500 percussion unit. Elevation of casing collar was 748 ft. above sea level, 1 ft. above ground level. Drilling began on 6th March, 1959, and total depth of 1,268 ft. was reached on 25th May, 1959. The well was plugged at the surface, and from 1,160 to 1,190 ft., and was abandoned on 30th May, 1959. Six inch casing was cemented to surface at 200 ft. Five inch casing was used as following string and withdrawn after reaching total depth. The sediments penetrated from surface to 1,168 ft. consisted mainly of mudstone with marine fossils in some bands; these beds have been correlated with the Tambo and Roma Formations. The base of the Tambo Formation is possibly at 465 ft. where there is a slight change in lithology. The uppermost aquifer of the Blythesdale Group was met at 1,168 ft., and 100 ft. of sandstone and sandy mudstone of this formation were penetrated to the total depth of 1,268 ft.

The driller reported an oil scum while drilling very fossiliferous beds at 722 ft. to 748 ft. Samples from this zone proved to be impermeable.

No gas was met.

The top of the Blythesdale Group was 174 ft. higher in this well than in L.O.L. No. 5. Comparison of the log of L.O.L. No. 6 with the logs of surrounding water bores, indicates that this well is situated on the north-east flank of the structure.

Longreach Oil Wells Ltd. No. 1 (Longreach)

This well was drilled partly by Oriomo Oil Ltd. and partly by Oil Search Ltd., to produce heavy oil and wax found when sinking the two Longreach water bores, No. 1 and No. 2. The deep test was preceded by scout drilling.

The well is located 7 chains north-east of Longreach water bore No. 1. Surface elevation is 620 ft.

Drilling began late in 1928 and ceased at 3,351 ft. on 14th February, 1931.

The base of the Cretaceous marine sediments was reached at 2,323 ft. and the base of the Blythesdale Group at 2,603 ft. The sequence from 2,603 ft. to granite basement at 3,268 ft. consists of grey shale, brown shale and sandstone, the lowest 50 ft. being coaly and sandy.

Gas sampled at 2,336 ft. consisted of 66·2 per cent. methane and 33·8 per cent. inert gas. Shows were recorded at 2,486 ft., 2,630 ft., 2,923 ft. and 3,229 ft. The latter show gave 9·1 per cent. carbon dioxide, 72 per cent. methane, 18·9 per cent. inert gas on analysis.

Samples examined in 1952 gave positive acetone tests at 640 ft. and 3,235 ft. Oil was reported at 2,486 ft., with wax giving 98·5 per cent. petrolene and 1·5 per cent. asphaltine on analysis; at 2,910 ft., and at 3,227 ft., where 1 gallon of oil and 3 gallons of water entered the bailed hole per day.

Artesian water was struck at 2,323 ft., 2,900 ft. and 3,146 ft. Some water entered the lower part of the hole during testing. A temperature of 180° F. was recorded at 3,164 ft.

Thirty feet of 11¾ in. surface casing was cemented; 8 in. casing was cemented at 1,287 ft. Six and three-eighths inch casing was seated at 3,164 ft. effecting water shut off.

With bottom of the hole at 3,243 ft., bailing to 1,600 ft. produced 5 gallons of oil. The casing was lowered to 3,204 ft. and cemented. Bailing tests produced small quantities of oil, wax and water.

A fatal accident occurred when preparing to shoot the well; after several months delay, Oil Search Ltd. deepened the hole to basement at 3,253 ft. and drilled decomposed granite and pegmatite to 3,351 ft.

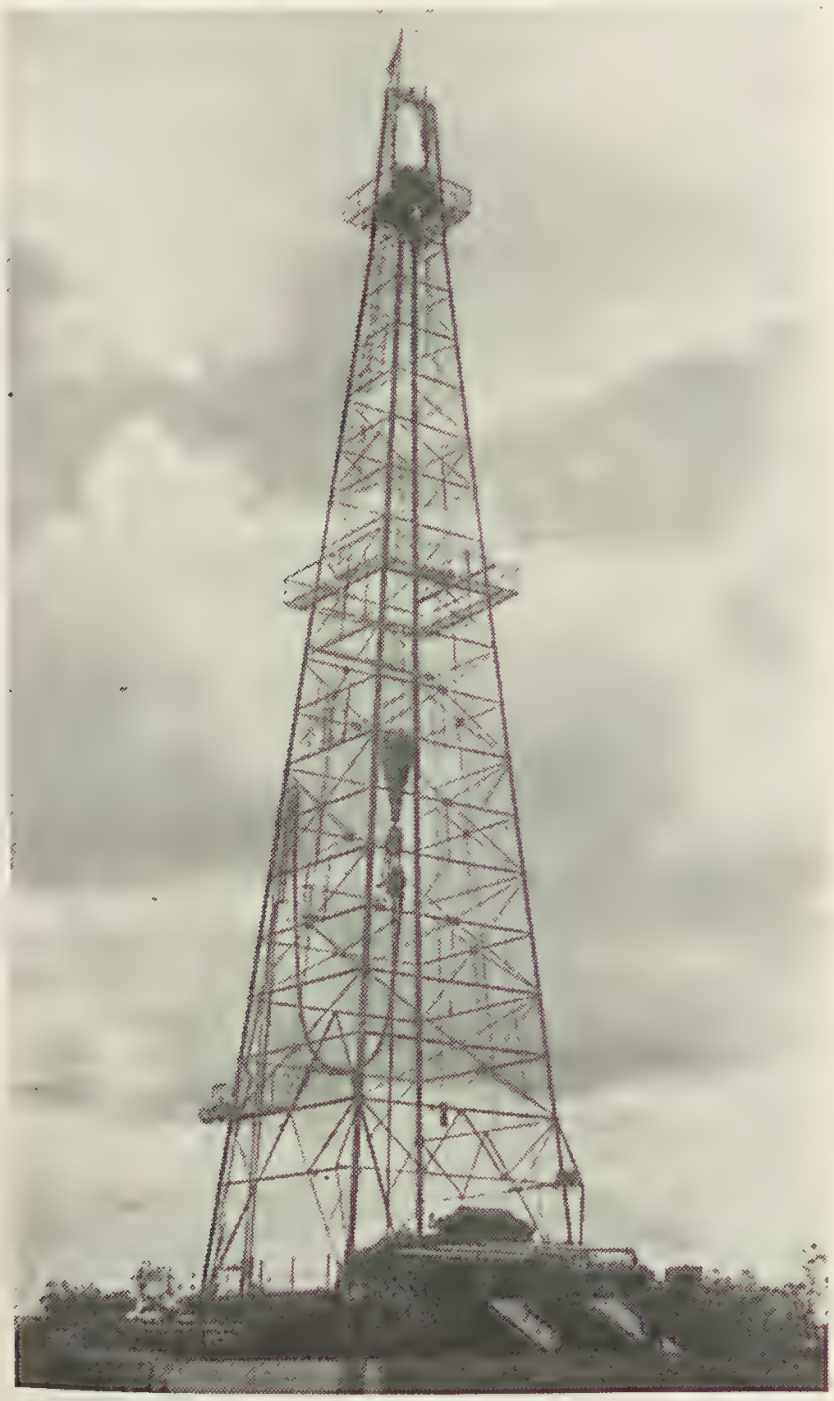
The well was closed down on 14th February, 1931, by filling with heavy mud to the casing shoe, then 50 ft. of cement, then mud to surface.

Lucky Strike Drilling Co. No. 1 (Cherwell) (Fig. 12)

This well is located in the parish of Cherwell, county of Cook, 25 miles north-west of Maryborough. Coordinates of the position are lat. 25° 14′ 43″ S., long. 152° 28′ 36″ E. Elevation of the site is 56 ft. above sea level, and rotary table elevation, from which all depth measurements were made, was 73 ft.

The well was drilled on the crest of the Cherwell Creek Anticline by Oil Drilling and Exploration Ltd., using a National 80B rotary plant. Drilling commenced on the 8th November, 1954, and total depth of 9,773 ft. was reached on the 6th March, 1955. To date, this is the deepest well drilled for oil in Queensland.

Initially a 12¼ in. hole was drilled to 800 ft., then reamed to 17¼ in. From this point to total depth, 8¾ in. hole was drilled. One string of 13⅜-in. O.D. casing was seated at 764 ft. and cemented to surface.



Oil Drilling and Exploration Ltd.'s National 80B rig drilling a deep test (9,773 ft.) for Lucky Strike Drilling Co. at Cherwell Creek, near Maryborough.

The formations penetrated consist of Elliott Formation from surface to 55 ft., Burrum Coal Measures to 1,490 ft., Maryborough Formation to 7,570 ft. and Grahams Creek Volcanics to 9,773 ft.

The Burrum Coal Measures consist of grey, white and green coloured, fine-grained sandstone, and grey to black sandy and carbonaceous shale, with a few thin bands of sandy limestone. Black bituminous coal was recorded in the interval 395 ft. to 1,020 ft.

The Maryborough Formation consists for the most part of marine, grey to dark grey shale and sandy shale with some fine-grained sandstone and dense limestone. The sandstone, which is better developed in the upper part of the formation, is uniformly tight and virtually devoid of porosity.

The Grahams Creek Volcanics consist of sandy shale and siltstone between 7,570 ft. and 8,345 ft., and mainly volcanics (tuffaceous sandstone and conglomerate, tuff and ash beds with a few thin beds of coal) below 8,345 ft. Seventeen cores were taken between 2,740 ft. and 9,773 ft., and in none of these cores were indications of oil or gas apparent. An electric log of the well run by Oil Drilling and Exploration Ltd. also failed to indicate the presence of any accummulation of hydrocarbon. The logs indicated a thick column of fairly homogeneous material, with little variation in either lithology or porosity.

The well was abandoned after being filled with heavy mud, and plugged with cement from 20 ft. to surface.

L.S.D. No. 2 (Susan River) (Fig. 12)

This well is situated in the south-east section of portion 2v, parish of Urangan, approximately 15 miles north-north-east of Maryborough. Ground level at the site is 49 ft. above sea level, and rotary table elevation was 66 ft.

The well was drilled to test the Susan River Anticline. Drilling by Oil Drilling and Exploration Ltd. commenced on the 9th April, 1955, and was completed on the 9th August, 1955, at a depth of 8,069 ft. A National 80B rotary plant was used.

A 12¼ in. hole was drilled from surface to 291 ft., then reamed to 17¼ in. to a depth of 274 ft. From this point to total depth an 8¾ in. hole was drilled. The only casing used in the well was a surface string of 13⅜ in. casing seated at 265 ft. and cemented to surface.

The penetrated section consists of Maryborough Formation from surface to 4,160 ft. and Graham's Creek Volcanics from 4,160 ft. to 8,069 ft. Lithologically, the Maryborough Formation consists of hard, silty shale, shale and siltsone with thin beds of brownish limestone and very minor developments of sandstone. The Grahams Creek Volcanics contains in the upper

part 750 ft. of black carbonaceous shale of fresh-water origin and below this rocks of volcanic origin—tuffaceous sandstone, tuff, volcanic conglomerate and ash beds.

In all, fourteen cores were taken with a wireline core barrel; in none of these was any indication of oil or gas seen. The well was logged electrically by Oil Drilling and Exploration Ltd., the log indicating very little variation in porosity and with no suggestion of any concentration of hydrocarbons.

On abandonment, the hole was filled with heavy mud and the top 20 ft. of the well plugged with cement.

Mackay Oil Prospecting Syndicate Scout Bores

These scout bores were drilled for the purpose of testing the significance of reported oil seepages at several points along the coastline in the Mackay area. Nos. 1-4 bores were drilled with a Failing 750 rotary rig by Oil Drilling and Exploration Ltd., and No. 5 with an Hydromaster 1500 percussion rig.

M.O.P.S. Scout Bores No. 1 and No. 2 (Half Tide)

These are situated on the coastline 10 miles north-north-east of Sarina in portion 1,296, parish of Hector, county of Carlisle. They were drilled in December 1955. Six and half inch diameter boreholes were sunk to a depth of 55 ft. in No. 1 and to 130 ft. in No. 2. The elevation above sea level of the sites was 10 ft. and 15 ft. respectively. The country rocks are silicified sandstone and pyroclastics, heavily intruded with intermediate and basic dykes. The holes were abandoned.

M.O.P.S. Scout Bore No. 3 (Hay Point)

The site is 12 miles north-north-east of Sarina, in portion 742, parish of Hector. It was drilled in December 1955, to a depth of 150 ft. The elevation above sea level of the site is 80 ft. The rock succession penetrated was similar to that in Scouts Nos. 1 and 2 (Half Tide).

M.O.P.S. Scout Bore No. 4 (Cape Hillsborough)

The site is on the coastline, 19 miles north-north-west of Mackay, in the parish of Ossa, county of Carlisle. The elevation above sea level of the site is 10 ft. It was drilled in January 1956, to a depth of 303 ft., and penetrated fresh-water shales with some sandstone and grit of Tertiary age. Electric logs were taken. The hole was abandoned.

M.O.P.S. Scout Bore No. 5 (Cape Hillsborough)

This bore is located near Cape Hillsborough, 2 chains from the high-water mark forming the southern boundary of R. 60, Parish of Ossa. Surface elevation is 30 ft. above sea-level. The bore was drilled with an Hydromaster 1500 percussion rig, from December 1956 to October 1957. Final depth was 2,405 ft. The bore was cased to 2,330 ft., using 8 in. casing to 290 ft., 6 in. casing from 290 ft. to 1,905 ft., and 4 in. casing from 1,905 ft. to 2,330 ft.

To 725 ft. the bore penetrated Tertiary (?) sediments, consisting of shale with minor sandstone to 225 ft. and sandstone from 225 ft. to 725 ft. From 725 ft. to total depth 2,405 ft., the bore penetrated Lower Carboniferous (?) green and purple andesitic tuff, some andesite and some tuffaceous sandstone; veins of quartz and calcite, and disseminated pyrite, occur below 905 ft. No shows of oil or gas were recorded.

Mackay Petroleum Prospecting Syndicate Scout No. 1 (Port Clinton)

This well was located by divination near the southern shore of Port Clinton, lat. 22° 39′ S., long. 150° 45′ E. Surface elevation is approximately 10 ft. The well was drilled between 1938 and 1941. It penetrated 135 ft. of clay, sand and gravel above metamorphic rock. Total depth was 363 ft.

Malta Oil Company No. 1 (Nive River)

This well is located 35 miles east from Tambo, at lat. 24° 55′ S., long. 146° 50′ E., near the head of Nive River, in the centre of portion 3, parish of Malta, county of Nive.

It was commenced in 1924 on a site selected by Dr. H. I. Jensen, and was at this time known as "Hodinotte's Bore." The Malta Oil Company took over the bore in 1925 at progress depth of about 600 ft. and deepened it to 1,160 ft. calling it "Blume's Bore." In 1926 the well was sold to Tambo Oil Syndicate, the stated depth being 1,385 ft. There is a doubt on the authenticity of this figure; in 1929 a log was submitted by Tambo Oil Syndicate of a well on their permit No. 104, which reached 1,160 ft. and compares with both Hodinotte's and Blume's information, so that they are assumed to be the same well.

The log shows sandstone to 22 ft., grey and brown shale with coal to 485 ft., grey sandy shale to 810 ft. and sandstone to 1,065 ft. with micaceous black and dark shale at 900–943 ft. Dr. F. W. Whitehouse's mapping shows the surface rock to belong to the Blythesdale Group, and it is concluded that the well penetrated 788 ft. of Walloon Coal Measures and 255 ft. of Bundamba Group. However, there is a possibility that the sediments below 900 ft. are of Permian age.

Oil scum was reported from several places in the carbonaceous shale sections, and from below the black shale at 900 ft., where it seemed to be associated with water in the sandstones.

Saline water is recorded at 92 ft. and 130 ft., and in the sandstone from 810 ft. to 900 ft. Fresh water is recorded from 943 ft. to bottom.

Melrose Petroleum Prospecting Co. Ltd. No. 1 (Alton Downs)

The well is situated in the south-east corner of portion 49, parish of Nicholson, county Livingstone, about 7 miles north-west of Rockhampton. It was sunk in 1921 with percussion tools by Melrose Petroleum Prospecting Co. Ltd.; the site was selected by divination.

The final depth reached was 700 ft. Strata penetrated consisted of alternations of clay, gravel and basalt containing some water. Dr. H. I. Jensen considered the sequence to be of Permo-Carboniferous or Carboniferous age. The well was abandoned.

Midcontinental Mines Co. No. 1

See A.R.O. No. 12 (Euthulla).

Mineral Oils and Water Pty. Ltd.

This well is situated on the west side of portion 261, parish of Bulimba, county of Stanley, near Creek Road, Mt. Gravatt, Brisbane. It was drilled to 560 ft. in 1939.

Ipswich Coal Measures were penetrated to 545 ft. (maximum), beneath which schist and quartz conglomerate bedrock was proved.

Gas was recorded at 475 ft., but was cased off. Water at 495 ft. was tested at over 400 gallons per hour.

Morella No. 1

See Shell (Queensland) Development Pty. Ltd.

Mount Walker Gas Bores

See Winneills Pty. Ltd.

Murilla Oil Company No. 1 (Boyanda)

This well is situated on portion 52, parish of Walla, on the north side of the railway line, 4 miles west of the town of Miles. Surface elevation is approximately 1,070 ft. The site was selected by divination.

Drilling commenced on 15th October, 1935, with percussion tools, and was suspended in 1953 at a total depth of 4,798 ft. In May 1948, the depth of the well was reported as 5,960 ft. A departmental check revealed the true depth to be 4,721 ft., and it has not been determined whether the excess footage was added over the entire depth of the well, or towards the bottom only. This means that the stratigraphic log is of little use as a record of formation thickness.

The log, as recorded, shows the base of the Blythesdale Group at 412 ft., the Walloon Coal Measures at 2,364 ft., the Bundamba Group at 3,489 ft. and the Moolayember Shale at 4,208 ft. From 4,208 ft. to 4,798 ft. the lithology recorded gives no indication of age. Steep dips were recorded shortly before the remeasurement, and formation penetrated since then suggests metamorphosed sediments.

The log shows the base of the Walloon Coal Measures to be at 2,364 ft., which gives a thickness of 1,295 ft. for this formation. This is some 700 ft. thicker than would be expected, so it is possible that some of the discrepancy in measured depths may be accounted for in this section of the hole. Casing is reported to have been set at 2,600 ft. and there was a suggestion that the Company try to check this measurement when the 4 in. diam. casing had been withdrawn. If the casing shoe were above 2,590 ft., then in all probability the strata log is in error.

Numerous gas and oil shows were logged by the driller, but only those having official verification are recorded here (Table III). At 2,130 ft. gas was reported in "running mud." The analysis showed 56 per cent. air and 11·4 per cent. ethane and higher hydrocarbons. At 2,510 ft. the Company sampled gas, which proved 35·1 per cent. ethane, etc. Samples collected a month later during swabbing tests, showed 12·7 per cent. and 10·4 per cent. ethane, etc., before bailing and 5·1 per cent. and 6·4 per cent. ethane, etc., after bailing. A sample collected at the same time was sent to Sydney University and analysed by selective refrigeration as 1 per cent. air, 98·7 per cent. methane and 0·3 per cent. ethane. This disagreement is puzzling as both the Bone and Wheeler apparatus and the refrigeration method are reliable.

Oil has been found by analysis in sludge samples from 3,630 ft., 3,763 ft., 3,825 ft., 4,568 ft., 4,721 ft. to 4,742 ft. (traces only).

Water was reported at 90 ft. (saline), 330 ft. (saline), 410 ft. (salty), 825 ft., 2,515 ft. (sodium chloride 552·0 grains per gallon, sodium carbonate 58·4 per gal.). For analyses see Table V.

The only cores examined departmentally were from 435 ft. to 455 ft. and 2,470 ft. to 2,538 ft.

Testing of the gas shows was very inefficient. No test was made of the gas at 2,130 ft., but it is stated that 1,500 ft. of fluid in the hole kept it in check. With total depth at 2,540 ft., bailings showed gas but in small quantity, with occasional oil films. Fluid level was 500 ft. The lower part of the hole is reported to have been drilled with only 500 ft. of fluid so that, from the casing shoe (seated at 3,600 ft.?) to the old measurement of 5,000 ft. depth, the strata contain no fluids of consequence. It will be noted that the 6 in. casing was cemented at 2,600 ft., which is below the gas shows at 2,510 ft.

Casing is as follows: 8 in. seated at 500 ft.; 6 in. cemented at 2,600 ft.; 5 in. casing was run and seated at 3,600 ft. The 5 in. casing was subsequently withdrawn and 4 in. diam. casing run to 4,750 ft. Later, the Superintendent recommended that the 4 in. casing be withdrawn, the hole reamed out below 3,600 ft. and 5 in. casing inserted. The 4 in. casing was removed, but it was then decided to suspend operations on the well.

L. G. Neill's Scout Bore No. 1 (Ten Mile Swamp)

This bore is situated 10 miles south-west of Ipswich, in resub. C, sub. 4 of portion 253, parish of Jeebropilly. Surface elevation is approximately 100 ft. above sea level.

The well was drilled with percussion tools to 314 ft., between November 1948, and January 1949.

Formations penetrated consisted of 26 ft. of Tertiary (?) and 288 ft. of Walloon shale, sandstone, thin limestone and some coal. A sample from 231 ft. was found to be dolomitic limestone.

No gas or oil was recorded. Water from 215 ft. contained 1,001 grains per gallon total solids (762·8 gr./gal. sodium chloride, 96·9 gr./gal. magnesium chloride, 46·7 gr./gal. calcium chloride, 51·3 gr./gal. calcium sulphate and 42·0 gr./gal. calcium carbonate).

The well was abandoned with casing left in.

L. G. N. Scout Bore No. 2 (Ten Mile Swamp)

This bore was drilled for natural gas, on resubdivision "C" of subdivision 4 of portion 253, parish of Jeebropilly, 900 ft. south of L.G.N. Scout Bore No. 1. Surface elevation is about 130 ft. above sea level. The driller was A. W. Holmes. Drilling began on 9th October, 1951, and finished on 31st January, 1952, at a total depth of 640 ft., which was the limit of the rig. The driller's log showed sandstone to 63 ft., dolomite to 132 ft., coaly shale to 150 ft., black coal with water to 160 ft., dolomite to 196 ft., grey sandstone to 215 ft., and alternating shale and sandstone to 640 ft. The sediments to 196 ft. are probably Tertiary in age; those from 196 ft. to 640 ft. are probably equivalent Walloon Coal Measures.

Oil Prospector's Ltd. No. 1 (St. Lawrence)

This Company sank a well in 1937 on Waverley Plain, near St. Lawrence. The well penetrated 52 ft. of gravel and 55 ft. of Permo-Carboniferous sediments.

Oil Search Ltd.

During 1930-32, Oil Search Ltd. drilled scout bores in the Roma and Longreach districts. Some 43 scout bores were drilled to an average depth of 160 ft. in the Warooby area, six miles east of Roma, to confirm a structure indicated by earlier scout drilling by Builders Ltd. Some 13 scout bores were drilled in the Cleeve, Oakley and Kelso areas near Longreach, and at Longreach itself, with the object of discovering favourable structures; the average depth of these bores was 370 ft., and maximum 838 ft. In 1935, a scout bore was drilled to 442 ft. on the Arcadia structure.

During 1934-39, Oil Search Ltd. drilled three deep tests, at Warooby, Hutton Creek and Arcadia.

Oil Search Ltd. No. 1 (Warooby)

This well was drilled by Drillers Ltd. for Oil Search Ltd., near the north-west corner of portion 11v, parish of Beaufort, 7 miles east from Roma. Surface elevation is 1,045 ft. Drilling with rotary plant began on 27th March, 1934, and total depth of 3,794 ft. was reached on 4th August, 1934.

The stratigraphic log suggests that the base of the Roma Formation was reached at 180 ft. The highest brown shale, which usually indicates the top of the Walloon Coal Measures, is recorded at 1,284 ft., a depth 400 ft. greater than that indicated by regional geology. It is more probable that this part of the log was incorrectly recorded, and the Blythesdale Group not distinguished, than that there has been a local facies change affecting 1,000 ft. of sediments, or that reversed faulting causes repetition of the Roma Formation. Placing the base of the Walloon Coal Measures at 2,660 ft. accords with the regional geology. The base of the Bundamba Group was reached at 3,021 ft. and that of the Moolayember Shale, the lower 250 ft. of which was arenaceous, was reached at 3,764 ft. Granitic basement was penetrated to 3,794 ft. A fault zone was cored at 3,733 ft.–3,736 ft.

Gas was seen escaping from cores at 3,629 ft.–3,645 ft. No oil shows were logged whilst drilling. The only water logged was at 1,102 ft. The temperature at 3,600 ft. was 130° F., corrections being applied.

Hole diameters are as follows:—15 in. from surface to 190 ft.; $10\frac{5}{8}$ in. from 190 ft. to 3,335 ft.; $8\frac{1}{4}$ in. from 3,335 ft. to 3,794 ft.

Twelve and one-half inch casing was seated at 190 ft. and 8 in. casing was run to 3,616 ft. and cemented. On abandonment, this casing was capped.

Coring commenced at 3,500 ft. Dips of 5° were recorded to 3,550 ft. and 15° to 20° to 3,700 ft. The fault zone at 3,733 ft. showed shear planes dipping at 75°, in the opposite direction to the dip of the bedding. At 3,743 ft. *Thinnfeldia* cf. *feistmanteli* (Permian to Lower Jurassic) was recorded.

Formation tests were made late in October 1934. When the packer was set at 3,350 ft., 1,000 ft. of gassy fluid entered the drill pipe. The packer was then set at 3,600 ft., and gas was produced; this gas contained 6 per cent. (average of samples) ethane and

Gas blowing at O.S.L. No. 1 (Warooby) well in 1952, eighteen years after plugging.

higher hydrocarbons (see Table III). No measurement of volume or pressure was recorded. Condensate collected during the test gave 50 per cent. distillation product at 424° F. and 96 per cent. at 558° F.

Eight inch casing was cemented at 3,616 ft. and the bottom of the hole filled with cement to 3,765 ft.

On 20th May, 1935, swabbing commenced with a packer set on tubing at 3,621 ft. Gas came in with water and blew for two days. Pitot tube measurements showed a maximum gas flow of 625,000 cu. ft. per day with 67,000 gallons of water per day. Closed in pressure reached 600 p.s.i., but it is not recorded how long after closing in this was reached, whether it was a maximum, or what amount of water was in the hole. The well was mudded off after seven days, on 27th May, 1935.

It has not been established whether water was entering the hole during this test. The packer was tested by putting 750 p.s.i. pressure on the annular space between the casing and tubing, and apparently showed no leak. Analyses of water at various times do not show clearly that it was not at least a mixture of artesian and bottom waters.

In October 1936, it was reported that gas was escaping between the capped 8 in. and 12½ in. casings, but no action is on record. The well blew out in March 1952, and was completely sealed in June 1952. Analyses of gas and water samples taken in 1952 are detailed in Tables III and V.

O.S.L. No. 2 (Hutton Creek)

This well was sunk by Drillers Ltd. for Oil Search Ltd. at lat. 25° 42′ S., long. 148° 42′ E., 61 miles north from Roma; surface elevation is 1,510 ft.

Drilling began on 5th October, 1935. Percussion tools were used to 3,715 ft. and rotary to total depth, 4,688 ft., which was reached on 29th June, 1938.

The Commonwealth Palaeontologist designated the formations penetrated as: Bundamba Group to 650 ft., Middle Bowen marine sediments to 892 ft., Middle Bowen fresh water sediments to 3,959 ft., and Middle Bowen mixed sediments containing radiolaria and plant remains to 4,688 ft. Shell (Q'ld.) Development placed the base of the Bundamba Group at 340 ft., the top of the Catherine Sandstone (top Middle Bowen) at 1,720 ft. (the coal measures from 900 ft. being Upper Bowen in age) and the basement, Drummond Beds (?) at 4,110 ft.

The well entered a fault zone between 3,963 ft. and 4,079 ft., the dip increasing from 30° to 60°, and the rocks becoming slaty (L. C. Ball). Below this zone the shale was indurated and some thin sections of core showed low-grade metamorphism. Plant remains found in cores below 4,079 ft. (including *Glossopteris* in the section from 4,464 ft. to 4,551 ft.) indicated that the well was still in Permian sediments. The well may not have reached the base of the Permian at the total depth of 4,688 ft.

Small gas shows were recorded during drilling but, with one exception, subsequent testing proved no volume present. At 2,325 ft. 13,000 cu. ft. of gas per day was tested. Analysis proved no ethane present (Table III).

No oil show of note was found. Water is recorded at 285 ft., 830 ft. and 900 ft., which rose to 330 ft.

Coring was selective with the percussion tools and almost continuous with rotary tools. Ten inch casing was seated at 344 ft. and subsequently cemented to surface; 8⅝ in. casing was seated at 1,379 ft. and 6⅝ in. at 1,814 ft. The 6⅝ in. string was removed for rotary drilling.

The gas show at 2,325 ft. was tested and the hole was almost dry when drilling below the 6⅝ in. casing to 2,715 ft., so this section of the hole was effectively proved barren and dry. Packer tests were made with bottom at 4,464 ft. and the packer set at 3,747 ft. and 3,727 ft., both tests obtaining some gas but the influx ceased after a short time. Samples analysed proved to be mostly of air, showing production was insufficient to fill the drillpipe. With bottom at 4,688 ft., packer tests made at 4,030 ft. and 3,730 ft. produced some gas, but insufficient to measure. There are no details regarding the effectiveness of these tests, such as whether the beam in the tester was clogged or clear on recovery but presumably the operators were satisfied that no producing horizon was overlooked.

A survey of the hole with Eastman equipment proved bottom to be 4,683 ft. deep, located 59 ft. north and 5 ft. west of the well head. At 750 ft. the bottom of hole was 56 ft. north of the well head. The well was abandoned.

O.S.L. No. 3 (Arcadia)

This well was located at lat. 25° 17′ S.; long. 148° 45′ E.; 85 miles north of Roma. Surface elevation is 1,310 ft. The well was drilled by Drillers Ltd. for Oil Search Ltd. between August 1936 and December 1939, using percussion tools to 4,110 ft. and rotary plant to 6,036 ft., total depth.

The well penetrated 180 ft. of basal Mesozoic rocks (Rewan Group), 5,820 ft. of Permian clastic sediments of the Bowen Group, and 42 ft. of andesite. Miss I. Crespin, Commonwealth Palaeontologist, divided the Permian sediments thus:—

STRATIGRAPHIC TABLE — O.S.L. No. 3 (ARCADIA)

180–1,785 ft. Upper Bowen		
1,785–5,994 ft. Middle Bowen	1,785–2,390 ft.	Marine grey shale with foraminifera and ostracods.
	2,390–4,374 ft.	Grey sandstone, grey and dark carbonaceous shale and coal.
	4,374–5,955 ft.	Mixed marine and fresh water carbonaceous shales, sandstone and conglomerate; radiolaria.
5,994–6,036 ft. Lower Bowen andesite*	5,955–5,994 ft.	Basal conglomerate (andesite pebbles).

*A number of core samples from this interval were examined in the Geological Survey and were found to consist of conglomerate similar to that occurring between 5,955 ft. and 5,994 ft.

Coring began at 4,112 ft. and showed disturbed strata at 4,618 ft. with dips up to 51°. Above this depth the dips range from 5° to 20°, and below it from 20° to 40° at 5,724 ft.

Gas was recorded and produced from several horizons (Table III). Gases from above 2,030 ft. were essentially methane, carrying over 5 per cent. ethane and higher hydrocarbons, and those from below 2,030 ft. were essentially carbon dioxide, carrying 2 per cent. to 3 per cent. ethane and higher hydrocarbons. Showings of non-inflammable gas in the drilling fluid are recorded between 4,110 ft. and 5,717 ft. and inflammable gas below 5,717 ft.

Production tests from 1,187 ft. gave 250,000 cu. ft. of gas per day; the section from 2,670 ft. gave 2,300,000 cu. ft. per day, and 235 p.s.i. closed-in pressure; and the section 2,887 ft. to 3,955 ft. gave 770,000 cu. ft. per day. The section 4,130 ft. to bottom (6,025 ft.) gave no production under test. Records indicate a maximum closed in pressure of 600 p.s.i. The reservoir pressure may be higher, as there was some liquid in the hole.

No oil shows were logged, though numerous traces are recorded, and the only water mentioned was 500 gallons per day at 700 ft. The well was plugged, filled with heavy mud, fitted with a control valve and abandoned.

Casing details are recorded as follows:—11¾ in. casing to 141 ft. (cemented); 8⅞ in. casing to 1,176 ft.; 6⅝ in. casing to 2,742 ft.

In 1942 the well was re-opened by the Commonwealth Department of Supply and Development for the purpose of obtaining further samples of gas for testing. The investigations demonstrated that the naphtha content of the gas between 2,520 ft. and 2,640 ft. was uncommercial.

With the well dry to 3,200 ft. and the 6⅝ in. casing perforated between 2,640 ft. and 2,520 ft., the 6⅝ in. casting was closed at the wellhead by a 6 in. high pressure threaded valve.

In July 1957, it was decided to permanently plug the well. A Christmas tree was fitted and a pressure of 750 p.s.i. was recorded with gas issuing at the rate of approximately 1,000,000 cu. ft. per day. The well was allowed to blow for 18 hours without any noticeable decrease in gas volume. Five hundred gallons of 1·4 sp. gr. mud were pumped in, after which the well was filled to the surface with 1·2 sp. gr. mud. The annulus between the 6⅝ in. and 8⅝ in. casing was filled with mud fluid, following which cement was forced in between the two casings. Cement was then poured into the annulus between the 11¾ in. and 8⅝ in. casing. The 6⅝ in. casing was cut below the gate valve, a bridging plug was forced down the casing to 20 ft. below the cellar, and the casing filled with cement to the surface. A ½ in. plate was welded over the 6⅝ in. casing, the section above the cellar floor being then encased with two 40-gal drums one above the other and the annulus between the casing and the drums filled with concrete. A steel plate set in the concrete bears the markings:—O.S.Arcadia; T.D.6038; plgd. 18.7.57.

Point Addis Oil Wells No. 1 (Mt. Abundance)

This well is situated on portion 18, parish of Waldegrave, south-west from Roma.

Drilling with percussion tools began on 19th November, 1928, and was suspended at 854 ft. on 10th August, 1929. Surface elevation is approximately 960 ft.

Roma Formation was penetrated to 770 ft. and Blythesdale Group to bottom, 854 ft. L. C. Ball placed the base of the marine Cretaceous at 485 ft., where 15 ft. of grey sandstone occurs; however, brown and blue shales, which are not typical of the Blythesdale sediments, persist to 770 ft.

Gas and oil shows were recorded in the Roma Formation, but as the water level was low while drilling and no samples were collected, these could not have been significant.

Water was recorded at 198 ft. (salty), 466 ft. (fresh) and 770 ft. The latter rose to 30 ft. from surface.

Ten inch casing was seated at 600 ft. and 8 in. casing followed the bit; all casing was subsequently removed.

Providence Oil Pty. Ltd. Scout Bore No. 1 (Twin Hills)

This well is located one-half mile west of the Disney Homestead, at lat. 21° 48′ S., and long. 146° 55′ E., approximately 80 miles north-north-west of Clermont. The elevation is approximately 640 ft. The well was drilled with percussion tools between May and July 1956 to verify a driller's record of traces of oil and gas in a water bore (Cockatoo No. 1).

The section consists of sandstone, grit and conglomerate from surface to 220 ft., and shale from 220 ft. to 477 ft. (total depth). The shale is mainly medium- to dark-grey shale alternating with greenish and brownish shale; some contains carbonate.

The age of the beds is uncertain. The upper section may be Tertiary, deposited as post-laterite valley fill; the shales, on lithological grounds, are probably of upper Palaeozoic age.

Petroliferous showings were reported from 438 ft. to 477 ft.; the presence of trachyte intrusions in the area suggests that the traces were probably derived from localised baking of the shales.

Queensland Coastal Oil Concessions N.L.

The Company drilled four (Nos. 1–4) shallow holes itself, and one (No. 5) in association with Tewantin Petroleum Company. Queensland Coastal Oil Concessions (North) drilled one well (No. 1).

Q.C.O.C. Nos. 1-3 are situated near the beach about 25 miles north of Tewantin.

Q.C.O.C. No. 1 (Tewantin)

This well was drilled from 18th December, 1922, to 20th December, 1922. The elevation of the site is 40 ft. above high-water mark. Total depth was 51 ft. in Cainozoic sediments.

Q.C.O.C. No. 2 (Tewantin)

This well was drilled from 27th December, 1922, to 15th January, 1923, at high water level at a locality 1½ chains north of No. 1. Total depth was 105 ft. in Cainozoic sediments. Gas was reported.

Q.C.O.C. No. 3 (Tewantin)

This well was drilled from 16th January, 1923, to June 1923, at high water level near No. 1. Cainozoic sediments of white sandstone, clay and gravel were bottomed at 168 ft., and followed by Mesozoic carbonaceous shale to 218 ft. Gas and oil were recorded at 115 ft. in gravel, and from 216 ft. Water under pressure was met at 140 ft. and 225 ft. The flow was shut off subsequently.

Q.C.O.C. No. 4 (Tewantin)

This well was situated 35 chains north from No. 1 and 4½ chains in from the shore-line, in Pandanus Gorge. Elevation is 35 ft.

Drilling began on 16th June, 1923, and ended on 3rd December, 1923. Tertiary sand and clay reached to 175 ft. depth, and Mesozoic shale with some sandstone was penetrated to 305½ ft. total depth. Gas was reported in the Cainozoic beds, and oil at 223 ft., 230 ft., 250 ft., 263 ft., and 281 ft. Water is recorded as strong at 225 ft.

Q.C.O.C. No. 5 (Tewantin)

This well was drilled about April 1924, at a locality 17 ft. east of No. 4 well. Elevation is 32 ft. Cainozoic sediments containing carbonised wood and pyrite were bottomed at 175 ft., and Mesozoic shale and sandstone were penetrated to 303 ft.

Gas and oil were reported from several depths, and water at 178 ft. and 284 ft.

Q.C.O.C. (North) No. 1 (Tewantin)

This well was drilled in 1924, in Quarry Gorge, 4 miles north of Pandanus Gorge. Elevation is 25 ft.

Mesozoic rocks were entered at 195 ft. Total depth reached was 835 ft. where tools jammed in the hole. The sediments consisted of grey and black shale and sandstone with coal below 482 ft. *Thinnfeldia odontopteroides* found at 500 ft. indicated that the beds were probably equivalent to Ipswich Coal Measures.

Gas and oil shows were recorded at numerous depths and water at 185 ft. and 700 ft.

There is no record of efficient testing of these showings but the existence of oil was confirmed by inspection.

Eight inch casing reached to 125 ft., 6 in. to 176 ft., and 5 in. was cemented at 599 ft.

Queensland Government No. 2 (Hospital Hill)

This well is included under oil bores because the production of gas from it began the search for oil in Queensland. It was actually drilled for town water supply to supplement the supply obtained in Q.G. No. 1 (Roma).

The well is located on the southern portion of reserve 53, Town of Roma. Surface elevation is 1,023 ft.

Drilling with percussion tools commenced on 28th June, 1899, and ended on 17th October, 1900, at 3,710 ft.

Formations penetrated were Roma Formation to 300 ft. (approximately), Blythesdale Group to 680 ft., Walloon Coal Measures to 2,648 ft., Bundamba Group to 3,249 ft. and Moolayember Shale to bottom, 3,710 ft.

Gas was struck at 3,683 ft. to 3,710 ft. No oil showings were recorded while drilling.

Water was recorded from 756 ft. to 1,358 ft., and at 2,965 ft. and 3,683 ft. The temperature of water and gas in February 1901, was 113° F.

Ten inch casing was seated at 482 ft., 8 in. at 1,233 ft., 6 in. at 2,577 ft., 5 in. to 3,452 ft. and 4 in. seated on bottom, 3,709 ft. 8 in. Subsequently the 4 in. string parted at 3,273 ft.

Gas was first noticed at 3,683 ft. when drilling "grey shale and mud." In 1901 gas flow was measured as 44,600 cu. ft. per day with 39,400 gallons of water per day. The gas contained 16·3 per cent. ethane and higher hydrocarbons (Table III). In 1904 the flow was 72,000 cu. ft. per day. The flow was not controlled for five years and in 1906 it was used for ten days to illuminate the town. On 16th June, 1906, the flow of gas ceased, but flow of water with traces of oil continued.

The hole was found blocked at 3,282 ft. and was abandoned in February 1911, without removing the obstruction or reviving the gas flow.

Q.G. No. 3 (Hospital Hill)

This well was originally known as "Roma Mineral Oil Co. No. 1" and was drilled under contract by Intercolonial Boring Co. The prospecting company was subsidised by the Queensland Government.

The well is situated near the north-west corner of reserve 191, Town of Roma. Surface elevation is 1,022 ft.

Drilling began in July 1907, with percussion tools, and total depth of 3,713 ft. was reached on 22nd March, 1910.

The section penetrated was Roma Formation to 215 ft. (approximately), Blythesdale Group to 650 ft., Walloon Coal Measures to 2,670 ft., Bundamba Group to 3,253 ft. and Moolayember Shale to bottom.

Gas came in at 3,702 ft. No oil was reported.

Water was met at 760 ft., 920 ft. (flowing 60,000 gallons per day), 975 ft., 1,260 ft. and some with the gas at 3,702 ft.

Ten inch casing was seated at 206 ft., 8 in. at 1,440 ft. with the lower 200 ft. perforated, 6 in. at 3,606 ft. and 5 in. to 3,688 ft. The top of the 6 in. casing was flanged to the 8 in. and a connection fitted to carry away water being produced from the artesian beds.

The gas struck at 3,702 ft. caught fire and burned for six weeks from 27th October to 11th December, 1908, before being extinguished. Gas still blew after the fire was killed, but the flow ceased after the well was sealed for three days.

Drilling was resumed, and at 3,713 ft. tools became stuck; in all, three sets were lost trying to clear the hole. The contractors ceased work on 16th March, 1910.

Q.G. No. 4 (Hospital Hill)

This well was drilled by the Queensland Government, to test the gas already proved in previous bores, and to explore the rocks below the gas zone. It is situated on subdivision 5, section XCV, Town of Roma. Surface elevation is 1,032 ft.

Drilling with percussion tools commenced on 22nd December, 1915. The well was officially "opened" on 29th January, 1916, and had reached 3,702 ft. on 24th May, 1919, when the bit broke off in the bottom of the hole. Operations were resumed on 21st February, 1920. Efforts to clear the hole failed, and deviation was begun at about 2,300 ft., reaching 2,830 ft. on 12th July, 1922.

Formations penetrated are: Roma Formation from surface to 240 ft. (approximately), Blythesdale Group to 720 ft., Walloon Coal Measures to 2,663 ft., Bundamba Group to 3,270 ft. and Moolayember Shale to bottom.

Gas was recorded at 1,760 ft., 1,889 ft., 2,095 ft., 2,236 ft., 2,285 ft., 2,316 ft., 2,400 ft., 2,520 ft., 3,602 ft., 3,610 ft., 3,665 ft. and 3,690 ft.–3,702 ft. (Table III).

Black material giving some free oil was located at 2,815 ft. in the deviation hole.

Water occurred at 139 ft. (salty), 530 ft., 980 ft.–983 ft., 1,335 ft., 1,620 ft. and possibly some with gas at about 3,700 ft., though this was not definitely established (Table V).

Temperature at 2,400 ft. was 143° F. Calculated temperature at bottom, 3,700 ft., was 182° F.

Fifteen and one-half inch casing was cemented at 525 ft., 12½ in. at 1,421 ft., 10 in. at 3,545 ft. The 8 in. casing was lowered over the bit after it was lost, but the casing parted and dropped, becoming fast. The casing was picked up with a die and water circulated to wash away cavings. Jarring would not free the casing which was then cut at about 1,100 ft. and pulled. A cutter was attached to 6 in. casing and the 8 in. casing was cut at 3,624 ft.

After 1,300 ft. of the 6 in. casing had been withdrawn, a small amount of gas increasing in volume, was noticed. On 20th September, 1920, after all the 6 in. casing was removed, the well was controlled while the gas was tested.

A formation pressure of 1,420 p.s.i. was deduced. The gas gave 1·22 pints of gasoline per 1,000 cu. ft. Water flow was measured at 109,000 gallons per day. No gas volume is recorded.

The well was opened up, the gas having ceased to flow, and a spear run. This held up at 3,250 ft. The obstruction proved to be the lost tools which had been forced into the 8 in. casing.

The casing was cut and withdrawn from 3,024 ft. Six inch casing, with spear, was run to withdraw the section 3,024 ft.–3,624 ft. of 8 in. casing. The fishing string parted at 1,332 ft. after lifting the 8 in. anchor about 2 ft. The fall of the bottom portion of the fishing string drove the obstruction 50 ft. down the 8 in. casing.

The whole of the 6 in. string, with spear, was withdrawn and 8 in. water-tight casing, with spear and jars, run. This string parted near the bottom when pulling.

Attempts to revive gas to blow the obstruction up the hole, failed. The 10 in. casing was cut at 2,414 ft. and withdrawn.

The deviation hole was drilled from about 2,300 ft. and had reach 2,830 ft., when operations ceased.

Queensland Oil Corporation Ltd. No. 1 (Wolston)

The well is situated on portion 79, parish of Woogaroo, county of Stanley, 1¾ miles south of Wacol railway station. It is also known as Morry's Borehole. The site was selected by divination. Surface elevation is approximately 85 ft.

Drilling commenced on 15th July, 1920, and a total depth of 1,715 ft. was reached on 19th September, 1929. Frequent mechanical and other troubles caused long periods of inactivity.

Formations penetrated have been designated: Tertiary from surface to 29 ft., Bundamba Group (basal section) to 327 ft. and Ipswich Coal Measures to bottom, 1,715 ft.

Gas was recorded at 435 ft., 992 ft., 1,258 ft., 1,310 ft., 1,410 ft., 1,455 ft., 1,480 ft. and between 1,600 ft. and 1,713 ft. No sample was collected, but some shows were proved to be inflammable.

Traces of oil were recorded from numerous depths; those about 632 ft. and between 1,000 ft. and 1,259 ft. were confirmed by inspection as natural oil; quantities were negligible.

Water was recorded as fresh from 315 ft. to 420 ft. and salty between 460 ft. and 600 ft. No water was logged below 600 ft.

No casing was cemented in this hole, temporary seats being made for bailing tests. The hole was tested by bailing on several occasions and showings of gas and oil confirmed, but no quantity was produced. Fluid level was never lowered sufficiently to test the formation conclusively.

Queensland Oil Development Co. Ltd. No. 1 (Langdale)

This well is situated in the centre of portion 4, parish of Erneshia, about 35 miles south-west of Longreach, at lat. 23° 41′ S., long. 143° 59′ E. The elevation of the site is approximately 660 ft. The well was drilled in 1927 to a depth of 2,520 ft.

The well penetrated Cretaceous sediments from surface to 2,190 ft. and Blythesdale Group from 2,190 ft. to 2,520 ft.

Gas was reported from a depth of 1,928 ft.; an analysis gave the following results:—Carbon dioxide 1·3 per cent., methane 75·7 per cent., ethane and higher homologues 7·7 per cent., inert gas 15·3 per cent. No other information on this well is available.

Queensland Roma Oil Ltd. No. 1 (Gubberamunda)

This well is situated 20 miles north of Roma, on portion 19, parish of Gubberamunda. Surface elevation is 1,226 ft.

Drilling began with percussion tools on 21st August, 1928, and total depth, 2,841 ft., was reached on 5th April, 1930.

Basalt was reached at 90 ft. and persisted to about 395 ft., Walloon Coal Measures were penetrated to 1,790 ft., Bundamba Group to 2,375 ft., Moolayember Shale to 2,814 ft., and metamorphic rocks to 2,841 ft.

Gas was reported at 1,470 ft., 1,825 ft., 2,663 ft., 2,760 ft., 2,810 ft., 2,830 ft. Oil showings were logged at various depths in the Walloon Coal Measures and heavy mineral oil was proved in a sludge sample from 910 ft. Strong showings occurred at 1,823 ft., 2,663 ft., and 2,736 ft.

Water was logged at 1,450 ft., 1,520 ft., 1,800 ft., 2,210 ft. and near bottom.

Ten inch casing was seated at 140 ft., 8 in. at 1,838 ft. and 5 in. at 2,760 ft. Re-measurement near bottom proved that recorded depths were over-estimated by 76 ft. to a true depth of 2,789 ft. Presumably the 6 in. casing depth is correct, so the oil and gas shows supposedly tested by plugging and filling in sections may have been cased off.

Records of tests with a packer are incomplete but some gas was produced when the fluid level had been swabbed to 1,200 ft.

Robinson's Bore

See British Australasian Oil Syndicate.

Roma Alicker Ltd. No. 1 (Eumamurrin)

This well is situated on portion 3, parish of Eumamurrin, 30 miles north-north-west of Roma. Surface elevation is 1,425 ft.

Drilling commenced with percussion tools on 18th March, 1929, and was suspended at 912 ft. on 6th June, 1929.

The well penetrated 40 ft. of weathered clay and sand followed by Walloon Coal Measures to bottom. Several thin coal seams were logged.

A showing of gas is logged at 423 ft. Water was recorded at 60 ft. and 155 ft. (salt) and 423 ft. (fresh), standing 60 ft. from surface.

Ten inch casing was seated at 246 ft. and 8 in. at 831 ft. All casing was later removed. The Company went into liquidation.

Roma Blocks Oil Co. N.L. No. 1 (Mt. Bassett)

This well is located on portion 331, parish of Euthulla, 7 miles north-east of Roma. Surface elevation is 1,067 ft.

Drilling with rotary tools commenced on 28th March, 1929, and total depth, 3,561 ft. was reached on 22nd January, 1931.

The section penetrated is Roma Formation from surface to 213 ft., Blythesdale Group to 355 ft., Walloon Coal Measures to 2,250 ft., Bundamba Group to 3068 ft. and Moolayember Shale resting on granite at 3,515 ft.

Gas was recorded at 2,452 ft., 3,000 ft. and 3,375 ft. (Table III). Oil was recorded at 300 ft. (solvent test) in sandstone; at 3,445 ft.–3,447 ft.; 3,503 ft.–3,505 ft.; and 3,507 ft.–3,510 ft. (Table IV). Water was logged at 565 ft. (Table V). Temperature of water at 3,445 ft. was 137° F.

Coring commenced at 1,444 ft., and was almost continuous from 2,750 ft. Dips of 30° to 45° were recorded at 3,415 ft.–3,453 ft. Porosities of 24·6 per cent. at 3,440 ft. and 17·7 per cent. at 3,505 ft. were measured.

On 11th October, 1929, with the bottom of the well at 3,382 ft., hot water was pumped to the hole and, as a result of agitation, gas appeared. On 8th November, 1929, cement plugs were placed at 2,600 ft.–2,550 ft. and 3,050 ft.–3,000 ft., while the drill was shut down, and the section above 2,550 ft. was tested. At this time the bottom of the well was still at 3,382 ft. Non-petroliferous gas was obtained but there are no details of volume, etc.

Sixteen inch casing was cemented at 187 ft. and 8⅝ in. casing was cemented in a 10⅝ in. hole at 3,440 ft. on 1st October, 1930. Two hundred sacks of cement were pumped.

In October 1930, with the bottom of the hole at 3,447 ft., bailing tests began. On 27th October, 27 gallons of oil were bailed and gas was showing while testing the casing. On 29th, the hole was bailed dry and before closing the well on 30th, 81 gallons had been bailed. Water entered the hole at the rate of about 30 gallons in 18 hours. In 7 days, 150 gallons of oil were recovered with little gas. Over the next week 116 gallons were recovered. The oil had a specific gravity of 0·8765 at 29° C., and 50 per cent. distilled below 335° C. No petrol fraction was present.

The hole was deepened to 3,460 ft. and again bailed dry, when 62 gallons of oil were bailed over 3 weeks. The water-oil ratio was 20 to 1. The water was never clear.

On 8th December, 1930, drilling was resumed, and total depth, 3,561 ft. was reached on 23rd January, 1931. During these deepening operations, the 8⅝ in. casing split from 3,419 ft. to 3,427 ft., that is from 13 to 21 ft. above the shoe. Attempts to wedge the casing and strengthen with cement failed. Drilling reports show that formation was picked up from the split, although it occurred in the cemented portion.

After reaching total depth, the well was plugged back to 3,514 ft. with cement and packed to 3,495 ft. with rubble. A 6 in. liner was run to 3,418 ft. and cemented back, the top of the liner being at 3,110 ft. This liner was intended to strengthen the defective 8⅝ in. casing and the upper oil sands while testing the lower ones. Actually the bottom of the liner was above the bad section.

The well was cleaned to bottom and bailing tests conducted. No record is available, but as the well was shot with 50 lb. and 62½ lb. of explosive on 3rd and 5th March, no production could have been obtained.

On 9th March a bridge at 3,414 ft., caused by the explosion, was cleared. There is no record of activities after this date.

The hole is reported to have been plugged at 3,414 ft. and all casing removed, but this does not seem correct.

In July 1937, the well was bailed in the presence of Commonwealth Oil Board members. Gas and oil showed in the bailings, and water was entering the hole at about 100 gallons per hour. The accumlation of oil was small so the well was again closed in.

R.B.O. No. 2 (Mt. Bassett)

This well is situated on Mount Bassett, 9 miles north-east of Roma and 2½ miles east-north-east of R.B.O. No. 1. Surface elevation is 1,603 ft.

The site was selected after detailed surface geological surveys by the Company. Drilling commenced on 10th August, 1938, and finished at 4,050 ft. in mid-1939. Rotary plant was used.

Basalt was penetrated to 55 ft. From information available, the base of the Roma Formation appears to be at about 800 ft. The Blythesdale Group cannot be distinguished. The base of the Walloon Coal Measures is at 2,596 ft. and the base of the Bundamba Group at about 3,400 ft. Granite basement was reached at 4,019 ft.

Gas was reported in the lower part of the hole. Some of this gas was obtained during bailing tests and proved to be non-petroliferous.

Oil traces were recorded at 3,798 ft. and 3,811 ft. Bituminous matter was noted in cores from 3,762 ft. to 3,770 ft. and petroliferous odour was noticed in a core at 3,985 ft.

No water was recorded. Testing produced only dry gas and saline water.

Eleven and three quarter inch casing was cemented at 285 ft. and 8⅝ in. at 3,772 ft. The well was surveyed with Eastman equipment to 3,880 ft. This point is 115 ft. north and 20 ft. west of the well head.

R.B.O. No. 3 (Mt. Bassett)

The position of the well is one mile south-east of R.B.O. No. 1, on portion 450, parish of Euthulla. Surface elevation is 1,163 ft.

Drilling with rotary plant commenced on 31st October, 1939, and total depth, 3,629 ft., was reached on 2nd March, 1940.

The base of the Roma Formation was reached at 300 ft., Blythesdale Group at 480 ft., Walloon Coal Measures at 2,322 ft. and Bundamba Group at 3,192 ft. Moolayember Shale rests on granite bedrock at 3,625 ft., the basal sediments being coarse arkose.

Gas was produced from 3,586 ft. to 3,629 ft. at 60,000 cu. ft. per day (Table III). No oil was produced from 3,586 ft. under test, although oil sands were logged as from 3,554 ft. to 3,557 ft. and 3,614 ft. to 3,617 ft. (Table IV). Salty water entered the hole from below 3,586 ft. No shows are logged in the higher part of the hole.

Fifteen inch casing was cemented at 285 ft. Coring was done in the lower part of the hole.

On 2nd April, 1940, the upper sand, 3,554 ft.–3,557 ft. was tested with a rat-hole packer. The test was not carried out correctly, but inflammable gas was proved. On 17th April a second test was made. The state of the hole was as follows:—10⅝ in. diam. to 3,506 ft.—tapered to 7⅝ in. diam. from 3,506 ft. 10 in. to 3,607 ft.—tapered to 5⅝ in. diam. from 3,607 ft. 10 in. to 3,621 ft., the top of a cement plug. The cement plug blanks off arkose overlying basement.

After several attempts to seat the packer at 3,607 ft. to test the lower sand, it was decided to test by seating the packer at 3,586 ft. This test proved 60,000 cu. ft. of gas carrying 2 per cent. ethane etc. Leaking closed-in pressure was 42 p.s.i. with 535 ft. fluid in drill pipe (Table V).

A cement plug was set from 3,629 ft. to 2,516 ft. and the top of the hole plugged before suspending operations on 30th October, 1940.

R.B.O. No. 4 (Mt. Bassett)

This well is located on the north-central part of portion 473, parish of Euthulla, 30 chains south-west of R.B.O. No. 1. Surface elevation is 1,029 ft.

Drilling, with rotary plant, commenced on 19th November, 1940, and total depth, 3,660 ft., was reached on 18th June, 1941.

The base of the Roma Formation was reached at 220 ft., the Blythesdale Group at 400 ft., the Walloon Coal Measures at 2,280 ft., the Bundamba Group at 3,080 ft. Moolayember Shale rests on granite basement at 3,611 ft.

Gas was recorded at 2,590 ft., and gas was obtained while testing the lower part of the hole (Table III). Oil was recorded in sandstone from 3,497 ft. to 3,508 ft. and at 3,566 ft. and 3,572 ft. (Table IV). Water was recorded at 1,010 ft. and saline water entered when testing (Table V).

Selective coring was done throughout, being almost continuous over the last few hundred feet. Casing was cemented at 184 ft. Six and five-eighth inch casing was cemented at 3,484 ft. on 2nd April, 1941, when bottom was at 3,514 ft.

The oil sand at 3,497 ft.–3,508 ft. was tested on 14th March, 1941 (before setting casing), by setting a formation tester at 3,459 ft. After 2½ hours, 300 gallons (1,270 linear feet) of mud, water, and oil, somewhat gas-cut, entered the drill pipe. The gas collected from the fluid in the drill pipe contained 4 per cent. ethane, etc.; the water gave 69·3 grains per gallon sodium chloride and 66·4 grains per gallon sodium bicarbonate, indicating mixing of artesian and bottom waters. No gas volume is recorded and it is not known if the tester beam was found to be plugged on withdrawal.

Roma Oil Corporation No. 1 (Hospital Hill) well at Roma.

On 16th April, after setting 6⅝ casing at 3,484 ft., with bottom at 3,514 ft., the hole was bailed and 10 gallons of oil were collected. Some gas is recorded, also water, but apparently the production was small.

After deepening the well to 3,660 (total depth) bailing lowered the fluid level to 3,525 ft. on 19th June, 1941.

There are no further records so, presumably, results were negative.

Roma Cornwall Dome N.L.

See A.R.O. No. 6 (Cornwall)

Roma Dome Ltd. No. 1 (Alicker)

This well is situated in the parish of Cornwall, 25 miles north-west of Roma, at the head of Alicker Creek. Surface elevation is 1,397 ft.

Drilling, with percussion tools, commenced on 28th November, 1928, and total depth, 2,255 ft., was reached on 14th September, 1929.

The well penetrated Tertiary clay and sandstone to 45 ft., Walloon Coal Measures to 875 ft., Bundamba Group to 1,688 ft. and Moolayember Shale to 2,235 ft., where granite basement was reached.

Gas was logged at 265 ft. and 345 ft. At 1,313 ft. odour of gas was noted. Oil shows were recorded from 1,326 ft. to 1,565 ft. Water occurred at 106 ft., 1,823 ft. and 2,124 ft.

Ten inch casing was seated at 108 ft. With bottom at 1509 ft., the 8 in. casing was cemented at 1,180 ft. after bridging at 1,232 ft., but the job was not completed and the casing was set set at 1,217 ft. Water broke in and drilling continued without further delay.

After reaching total depth, the hole was bridged at 1,344 ft. and filled to 1,320 ft. with stones, and to 1,290 ft. with sand. Bailing would not lower water level below 315 ft. The 8 in. casing was re-cemented but bailing could not empty the hole after drilling through the cement at the shoe, so the well was abandoned. No showing of oil or gas was noticed during bailing.

Roma Government No. 2-4 Bores

See Queensland Government Nos. 2-4 (Hospital Hill).

Roma Mineral Oil Co. No. 1

See Queensland Government No. 3 (Hospital Hill).

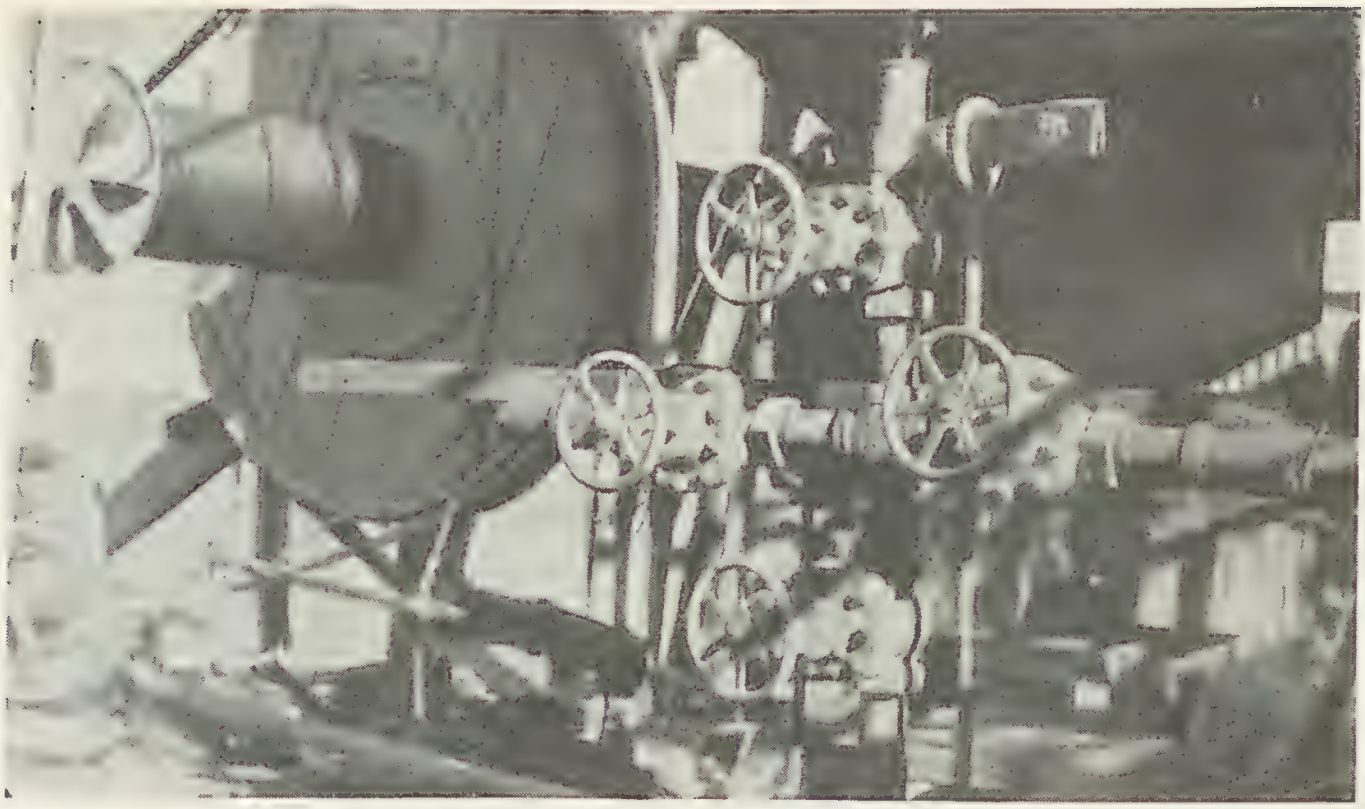
Roma Mooga Oilfields N.L. No. 1

See A.R.O. No. 7 (Solitary Creek).

Roma Oil Corporation No. 1 (Hospital Hill)

This well is situated on section XCV, subdivision 9, Town of Roma. Surface elevation is 1,040 ft.

Drilling with rotary tools commenced on 9th February, 1927, and on 13th September, 1927, reached 3,703 ft., where gas was produced. The well was deepened to 3,875 ft. between 29th June, 1929, and 25th October, 1929, in an attempt to find an oil sand.



R.O.C. No. 1 (Hospital Hill). The "Christmas Tree".

Roma Formation was penetrated to 220 ft., Blythesdale Group to 765 ft., Walloon Coal Measures to 2,650 ft., Bundamba Group to 3,210 ft., Moolayember Shale to 3,859 ft. and metamorphic basement to total depth.

Gas was recorded at 1,715 ft., 1,790 ft., 3,321 ft., 3,380 ft., 3,570 ft., 3,598 ft., 3,661 ft.–3,670 ft. (petroliferous) and 3,703 ft., the production depth. Gas was logged at 3,727 ft., 3,770 ft. and 3,860 ft., when deepening (Table III).

Traces of oil were recorded at 3,300 ft. and 3,403 ft. Condensate was obtained when producing gas from 3,703 ft., and an oil sand was cored from 3,703 ft. to 3,727 ft. (Table IV.).

Water was logged at 415 ft., 925 ft., 980 ft., 1,300 ft.–1,420 ft., 1,600 ft., 2,660 ft., 2,740 ft. and salt water from below 3,700 ft., Bottom temperature was estimated at 140° C. by C. Ogilvie (Table V).

Cores were taken from 2,716 ft. Dips of 35° were recorded at 3,707 ft.

Ten inch casing was seated at 2,716 ft. and 8¼ in. at 3,555 ft. The casing was cemented and the cementing tested on 22nd August, 1927.

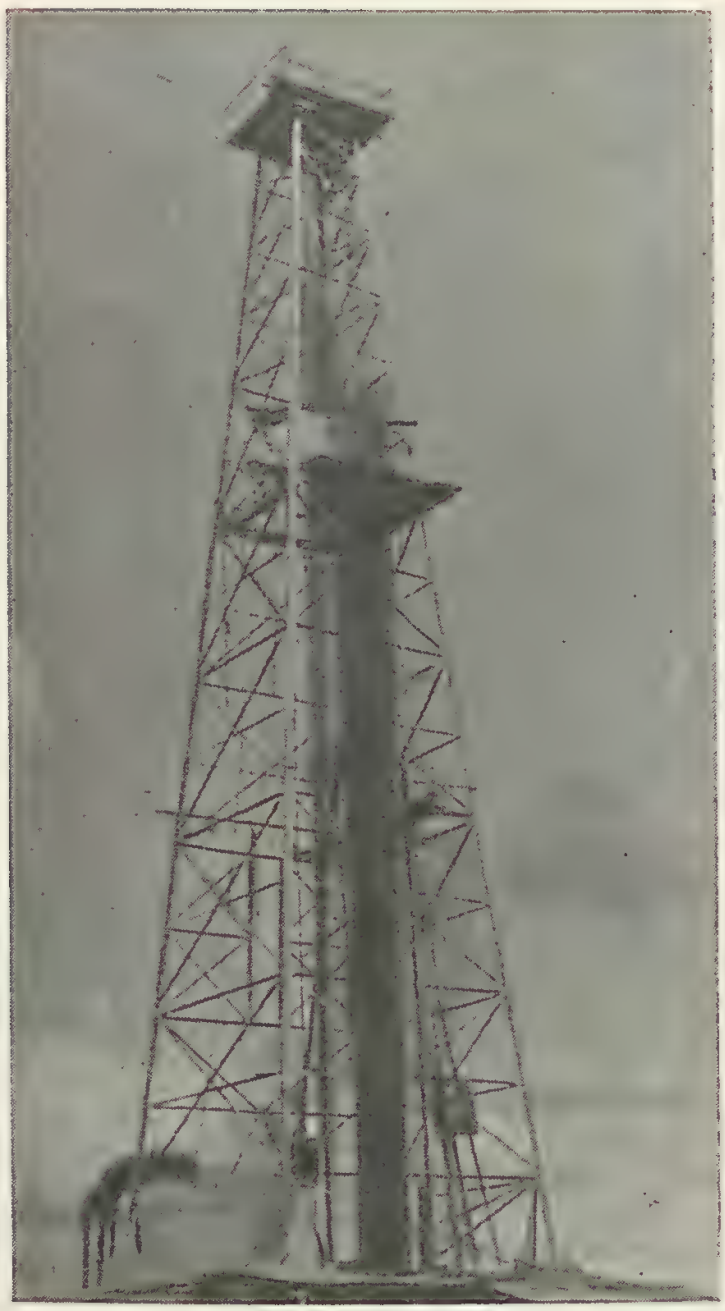
Because of the importance of this well an attempt is made to detail the operations after setting the 8¼ in. casing.

Swabbing with bottom at 3,685 ft. produced petroliferous gas at low pressure. With bottom at 3,696 ft. the hole was bailed to 2,600 ft. without production. At 3,703 ft. the drilling mud was thinned with water, and sand and cavings bailed from the bottom of the hole. Tubing (3 in.) was run to 2,800 ft. and swabbing commenced on 15th September, 1927. Gas began to show with fluid level at 1,600 ft. and "came in" shortly afterwards. Original formation pressure was estimated to be 900 p.s.i.

Tests were carried out over several weeks to determine the effect on production and pressures of closing the well in for irregular periods and opening up for short periods. A pressure gauge was attached to the casing blow-down line but not to the tubing.

Reports of early tests do not give gas measurements, but record pressures and volume of free oil, emulsion and saline water. The main points of note are that the closed-in pressure build-up is at the same rate as decline. The tests were apparently regulated to give production at about static pressure. At commencement, the closed-in pressure averaged 440 lb. p.s.i. and after 3,000 gallons or more of liquids had been produced, the average closed-in pressure was 470 p.s.i. Volumes produced are too small to affect reservoir conditions but indicate good permeability and suggest the rate of water inflow was, at that stage, small.

C. Ogilvie of the Irrigation and Water Supply Commission, investigated production during November 1927, and estimated gas output at 200,000 cu. ft. per day when the tubing was free of fluid. Relative pressures were 450 p.s.i. and 430 p.s.i. From this he deducted the reservoir pressure as 1,440 p.s.i. based on the gravity of fluid in the hole as 1, which is excessive as the fluid column would be very gas cut. He also deduced that the gas had a restricted inlet because there should be wider variation in gas flow at different (fluid) levels; this deduction is questionable, because the quoted production variations appear very wide for the pressure differences established. Pressure build-up rate is a more acceptable gauge of permeability than flow rate through water columns of different lengths. C. Ogilvie concluded that the liquid fractions were distillates so that the proportion obtained would be dependent on the flow pressure of the gas.



R.O.C. No. 1 (Hospital Hill). The first gas blow. August, 1927.

Production during October, November and December 1927, was 1,400 gallons of light oil from 12,000 gallons of fluid, by the method of opening the tubing for short periods each day and collecting the oil and emulsion produced before water came through.

In October 1928, an absorption plant was given a preliminary run; recovery was claimed to be 6 to 7 pints of gasoline per 1,000 cu. ft. of gas. Estimation tests done in 1927 gave 1¼ pints per 1,000 cu. ft.

The flow of gas diminished, and in January and February 1929 the gas flow was revived by swabbing and cleaning out sludge and sand from bottom.

In June 1929, it was decided to drill deeper to locate a possible oil sand. The hole was bridged at 3,604 ft. and caved from 3,632 ft. to bottom, 3,703 ft. Coring to 3,707 ft. showed sandstone, with pea-sized pebbles, saturated with oil.

The hole was cleaned out with a 7⅝ in. bit and a 168 ft. liner of 4 in. drill pipe with open hole packer and casing wall packer was run on tubing. The packer was set at 3,532 ft. with bottom of liner at 3,705 ft., the lower 6 ft. being perforated, and the open hole packer set at 3,699 ft. (driller's logs).

Depths given to L. C. Ball by the driller in charge were as follows:—Top of liner 3,540 ft.; bottom 9 ft. of liner perforated and set 2 ft. from bottom (3,705 ft.) with the full hole packer at 3,692 ft. and the casing wall packer at 3,541 ft. Thus the hole was open from 3,692 ft. to bottom, 3,707 ft.

Swabbing began on 3rd July, 1929, and gas production of 131,000 cu. ft. per day was obtained on 4th, giving 2 pints of gasoline per 1,000 cu. ft. by absorption. On 8th July the flow was 300,000 cu. ft. at 35 p.s.i. pressure through the absorption plant. On 9th July, the well was killed, tubing backed off and pulled, and tools run to recover packers, part of which broke off.

Drilling was resumed on 17th July, and sandstone with streaks of shale was cored to 3,729 ft., buff shale to 3,736 ft. and slaty shale to 3,771 ft.

The core hole was reamed to full size and cleaned out. A 4 in. liner was run on tubing with left hand joints 22 ft. above and 100 ft. below a packer, which was set at 3,526 ft. 8 in., bottom of liner 3,696 ft.

R.O.C. No. 1 (Hospital Hill). Gas burning at night.

R.O.C. No. 1 (Hospital Hill). The first production of oil (condensate), September, 1927.

Swabbing for three shifts brought in gas, which after 2 days flowed 446,000 cu. ft. per day (increasing) with 1,000 gallons water and some oil. Flow pressure on 27th July, 1929, was 50 p.s.i. On 1st August the flow was 1,250,000 cu. ft., flow pressure 60 p.s.i., specific gravity 0·63; the flow yielded 2 pints of gasoline per 1,000 cu. ft. Closed in pressure rose to 365 p.s.i. in 10 minutes, and was then released.

From 30th July, 1929, the absorption plant operated commercially and average 1·3 pints gasoline per 1,000 cu. ft. gas. The daily volume fell from 1,260,000 to 490,000 cu. ft. by the 14th October, when the plant was closed down.

The well was killed on 15th October, 1929, and the tubing backed off and pulled. The packer and liner were pulled after two runs with an overshot. The hole was bound to be bridged at 3,698 ft.

Coring begun on 17th October, and reached 3,875 ft. on 25th October. Gas was noticed while coring sandstone at 3,860 ft. to 3,864 ft.

R.O.C. No. 1 (Hospital Hill). Officials inspecting a swabbing test, 1927. L. to R. L. C. Ball, Government Geologist, Professor H. B. Richards, (University of Queensland) and Dr. W. G. Woolnough, Commonwealth Geological Adviser.

The hole was washed out but not reamed, and the liner and packer run on tubing. The packer was set at 3,514 ft. with bottom of liner at 3,680 ft. A left-hand joint was located at 3,494 ft. Swabbing produced gas and the absorption plant was re-started on 1st November, 1929.

No records are available until 31st March, 1930, when cement was pumped at 3,875 ft. through the tubing, and the bailer was lost. The tubing was pulled and most of the bailer recovered. Tubing was run to 3,800 ft. and 6 bags of cement were pumped to the hole and the tubing pulled back into the liner.

Records for the next three weeks are missing. After this, tubing was connected up with the liner again and the hole swabbed. No production was obtained, presumably owing to an obstruction in the liner, because previously the tubing was held up when trying to run to bottom. Attempts to clean out failed and operations were suspended between 27th May and 6th October, 1930, when a 2¼ in. bit was run on tubing and the obstruction cleaned out with showing of gas. The well was swabbed, but no production was obtained. The tubing and liner were pulled and it was found that the liner had parted at the left hand thread at 3,616 ft., leaving 64 ft. in the hole. Operations were suspended on 30th October, 1930, without removing the fish.

It is assumed that gas production continued during November and December 1929, and early in 1930, and that subsequent operations were intended to revive diminished flow and possibly cement off the bottom part of the hole. Unfortunately, the reason for suspension of operations is not known, nor are there any details of production data in the latter stages, from which reservoir conditions could be judged.

Probably rotation with the 2¼ in. bit unscrewed the liner and it was pushed down the hole, effectively plugging the production section.

In February and March 1931, swabbing revived a flow of 300,000 cu. ft. per day, giving 2 pints gasoline per 1,000 cu. ft. Very little water accompanied the gas.

The well was later taken over by Australian Roma Oil Ltd. and designated as A.R.O. No. 16.

R.O.C. No. 2 (Hospital Hill)

This well is located at the corner of allotments 1, 2, 9 and 10, section XCIX, town of Roma. Surface elevation is 1,051 ft.

Drilling began with rotary tools, on 28th March, 1928, and total depth, 4,005 ft., was reached on 19th February, 1929.

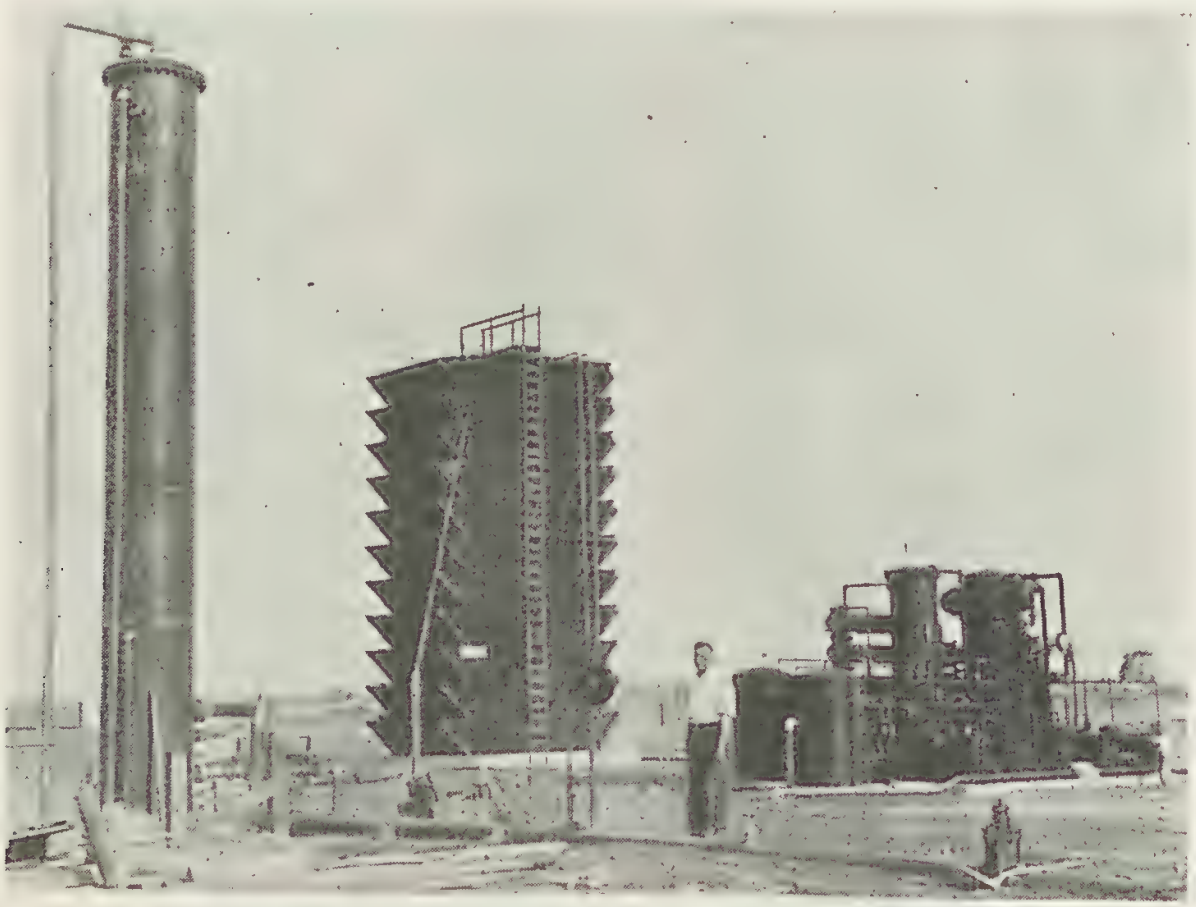
Roma Formation was penetrated from surface to 220 ft., Blythesdale Group to 780 ft., Walloon Coal Measures to 2,750 ft., Bundamba Group to 3,300 ft., Moolayember Shale to 3,955 ft. and metamorphic basement to total depth, 4,005 ft.

Gas was recorded at 2,450 ft., 2,846 ft., 3,450 ft., 3,665 ft., 3,810 ft., 3,875 ft., 3,900 ft. and 3,920 ft. (Table III).

Oil sands were recorded at 3,474 ft.–3,475 ft., 3,645 ft.–3,647 ft., 3,844 ft. and 3,910 ft. (Table IV).

Water was logged at 419 ft., 451 ft., 510 ft., 2,730 ft. and from between 3,800 and 3,900 ft. The last was saline. Temperature of mud from bottom was 127° F. on emission at surface (Table V).

Coring began at 3,163 ft. and continued to bottom. Dips were less than 5° to 3,170 ft., 8° to 3,300 ft., 6° to 3,700 ft., 4° to 3,955 ft. and 50°–70° in basement.



Roma Oil Corporation, Roma. The Absorption Plant, 1928.

Fifteen inch casing was cemented at 108 ft., 11¾ in. at 3,057 ft. and 8⅝ in. at 3,604 ft. with bottom at 3,606 ft. A 6¼ in. liner perforated from 3,910 ft. to bottom (3,924 ft.) was cemented from 3,910 ft.. Subsequently this liner was filled with cement. On abandonment the 8⅝ in. casing was recovered from 1,935 ft., and 6 bags of cement were placed in top of the remaining string.

On 11th March, 1929, tubing was run and the hole washed down from the shoe (3,604 ft.) to bottom, 4,005 ft. Swabbing commenced with tubing at 3,516 ft. With fluid level at 2,100 ft., salt water entered the hole, so it was cement filled to 3,862 ft. and cleaned out to 3,875 ft. Tubing was run to 3,005 ft., and swabbing commenced on 21st March, 1929. During swabbing, the tubing was lowered to 3,325 ft. and then 3,650 ft. Gas showings began with fluid level at 2,650 ft. and improved; no water entered the hole. With the tubing empty, closed in pressure was 205 p.s.i., but fell to 100 p.s.i. when blown down. No record of volume or time was kept. Samples collected analysed 15 per cent. ethane and higher hydrocarbons.

The walls were washed down and the cement drilled out to 3,908 ft. Fluid was bailed to 2,163 ft. and the hole made salty water at 200 gallons per hour. Twelve cubic feet of cement were pumped on cavings at 3,899 ft., filling the hole to 3,825 ft., showing either too much cement pumped or the plug lifted. It was drilled out to 3,840 ft. Bailing gave gas with water at 43 gallons per hour. The hole was opened to 3,865 ft. and gas with little water produced.

On 11th April, 1929, this gas tested 22,000 cu. ft. per day, 3½ pints gasoline per 1,000 cu. ft. It analysed 14·9 per cent. ethane and higher hydrocarbons.

When the cement fill was drilled to 3,924 ft. and the hole bailed, water with gas, oil films and black wax, entered at the rate of 528 gallons per hour. Water rose to 120 ft. overnight. Another 2 ft. opening up brought in more water.

This show from 3,910 ft. was considered better, so a 6⅝ in. liner was cemented to isolate the section 3,910 ft.–3,925 ft. Bailing tests proved water still entering the hole.

The well was abandoned by pumping 40 cu. ft. cement to 3,910 ft. and allowing it to set under back-pressure. The top of this plug was found at 3,800 ft. The well was filled to 3,620 ft. with sand, and to 3,570 ft. with cement. The 8⅝ in. casing was cut and recovered from 1,935 ft., a wooden plug and 6 bags of cement being placed on top of the cut.

In May 1939, the well was shot at 1,749 ft. to get water. No water show was logged at this depth when drilling, but after shooting the water level rose from 400 ft. to 40 ft., showing channelling from water sands to the rupture.

R.O.C. No. 3 (Hospital Hill)

This well is situated on the eastern edge of R147, Town of Roma. Surface elevation is 1,016 ft.

Drilling with rotary tools commenced on 26th November, 1929, and total depth of 3,732 ft. was reached on 11th February, 1930.

The base of the Roma Formation is placed at 420 ft., Blythesdale Group at 970 ft., Walloon Coal Measures at 2,670 ft., Bundamba Group at 3,247 ft. Drilling ceased in buff coloured shales, the top of which is at 3,720 ft. and is correlated with the top of similar shales below sandstone at 3,729 ft. in R.O.C. No. 1 and 3,760 ft. in R.O.C. No. 2.

Gas was recorded at 1,776 ft., 1,909 ft. and 2,074 ft.; production was obtained from 3,634 ft., 3,696 ft. and 3,709 ft. (Table III). Oil was recorded in cores from 3,634 ft. to 3,722 ft.

Water was logged only at 2,520 ft. and possibly 3,627 ft. (Table V).

Coring began at 3,229 ft. Twelve and a half inch casing was cemented at 301 ft. and 6⅝ in. at 3,600 ft. with 75 bags, after under-reaming out to 8⅝ in. diameter to 3,600 ft. The top 39 ft. of this string is 8⅝ in. seamless casing.

Bailing commenced after testing the casing and cleaning out to 3,612 ft. Gas began to show with some water with fluid level at 2,000 ft. Further tests proved gas and some water to 3,625 ft.

The hole was cleaned out to bottom and washed with water. Tubing was run to 3,595 ft. and swabbing commenced. An estimated flow of 100,000 cu. ft. with flow pressure 25 p.s.i. was obtained.

During April 1930, several attempts were made to induce gas to flow. The well was shot at 3,690 ft.–3,720 ft. and, after cleaning out to bottom and bailing, production was 160,000 cu. ft. per day on 1st May, 1930, giving 2 to 2·3 pints gasoline per 1,000 cu. ft. Closed-in pressure reached 620 p.s.i. in 7½ hours, still rising when released, but no fluid level is recorded.

The hole was filled from 3,715 ft. to 3,672 ft. with sand, and capped with 1½ cu. ft. of cement. Shooting torpedoes were run, placing one 5 ft. long containing cement on bottom, 3,669 ft., and two containing 100 lb. blasting gelignite each at 3,661 ft.–3,641 ft. After cleaning out to 3,665 ft., tubing was run to 3,593 ft. and swabbing began. By 11th May a flow of 73,000 cu. ft. had been induced.

These operations were designed to test separately the two gas shows 3,634 ft.–3,663 ft. and 3,696 ft.–3,720 ft.

Records are missing after 11th May, 1930, but Australian Roma Oil took over the well as A.R.O. No. 17 and produced gas from it until late 1931 at least.

R.O.C. No. 4 (Blythdale)

This well is situated on portion 55, parish of Blythdale. Surface elevation is 1,016 ft.

Drilling with rotary tools commenced on 26th June, 1930, and total depth, 3,839 ft., was reached on 16th September, 1930.

The base of the Roma Formation was reached at 360 ft., Blythesdale Group at 862 ft., Walloon Coal Measures at 2,730 ft. and Bundamba Group at 3,290 ft.

Gas was logged at 3,100 ft., 3,200 ft., 3,676 ft. and 3,830 ft. Oil was reported in sandstone from 3,832 ft. to 3,834 ft. Water horizons were not logged but a flow of 7,280 gallons per day was obtained when testing the oil sand at 3,828 ft. to 3,839 ft. This water was very alkaline so was probably leaking from a higher aquifer. A temperature of 102° F. was measured at 3,839 ft.

Cores were taken from 3,600 ft. to 3,830 ft. Fifteen inch casing was set at 65 ft., 10 in. at 1,503 ft. and 6⅝ in. at 3,828 ft. The latter was cut and plugged at 2,255 ft. with cement to 2,345 ft., sand to 2,265 ft. and cement to 2,253 ft. A 3 in. pipe was set at surface for water supply.

A perforated liner was set with packers to test the section 3,828 ft. to 3,836 ft. Water at 15,280 gallons per day and inflammable gas at 3,400 cu. ft. per day (sp. gr. 0·67, non-petroliferous) were produced in November 1930. Efforts to separate the gas and oil sands from water were not successful.

Roma Oil South Blocks No. 1

See A.R.O. No. 15 (Bungil).

Roma Orallo Ltd. No. 1

See A.R.O. No. 10 (Orallo).

Salt Domes Oil Syndicate No. 1 (Boonah)

This well is situated in the north-west corner of portion 76A, parish of Fassifern, county of Churchill, 7 miles north of Boonah. It is also known as (Father) Fagan's Bore.

It was drilled in 1927, to a depth of 525 ft., passing through 100 ft. of clay and 425 ft. of sandstone, shale and some limestone. No coal was reported, but the sequence belongs to the Walloon Coal Measures.

An inspection made in October 1927 proved the presence of gas at 525 ft., but the volume was negligible.

S.D.O.S. No. 2 (Boonah)

This well is situated 2 miles west-north-west of S.D.O.S. No. 1, on portion 58, parish of Fassifern. It is also known as Currier's Bore.

A depth of 413 ft. was recorded on 10th December, 1928.

The strata penetrated were shale and limestone to 67 ft., and carbonaceous shale below. The upper section may be of Tertiary age and the lower section Walloon Coal Measures.

Water was recorded at 170 ft. and oil scum at 77 ft. Records of these wells are very incomplete.

Santos Ltd.-Delhi Australian Petroleum Ltd. Scout Bores

In July-August 1959, Santos Ltd.-Delhi Australian Petroleum Ltd. conducted a scout drilling campaign near Burketown and on Mornington Island, in Carpentaria Sub-Basin. Twenty holes were drilled to a maximum depth of 1,000 ft.; total footage drilled was 16,280 ft. The contractor was W. H. Sides and Sons, and the rig a Failing 1500 rotary. The holes were logged lithologically, and electrically with a Widco single point electrode unit, lent by the Bureau of Mineral Resources.

Three scout bores were drilled near Burketown, between 25th and 31st July, 1959, while the party was awaiting transport to Mornington Island. S.D.A. Scout Bore No. 1 (Oakey Hole) was drilled 11 miles west of Burketown, to a depth of 1,000 ft. S.D.A. Scout Bore No. 2 (Nicholson River) was drilled 2 miles west of No. 1, to a depth of 300 ft. Both penetrated black calcareous shale. A third hole, No. 2A (Burketown) was drilled at Burketown to only 50 ft., at which depth it was abandoned due to caving of the formation (alluvial gravel).

From 5th to 29th August, 1959, 18 scout bores were drilled on Mornington Island, with the aim of determining the structure. S.D.A. Scout Bores Nos. 3-13 (Mornington Island) were drilled at intervals of 1-2 miles across the middle of the island, from north-west to south-east. S.D.A. Scout Bores Nos. 14-19A (Mornington Island) were drilled at intervals of about 4 miles down the length of the island, from north-east to south-west. Scouts Nos. 3-7, 12-13 and 15-18 were drilled to 1,000 ft.; Nos. 8-11 and 14 were drilled to 600 ft.; No. 19 was drilled to 650 ft. and No. 19A to 280 ft. The strata penetrated were freshwater and marine mudstone, calcareous mudstone and sandstone. Sludge samples from No. 3 bore were examined for foraminifera by Dr. N. H. Ludbrook, palaeontologist of the South Australian Department of Mines; the sediments were found to be of Upper Albian age to 660 ft., and probably Middle Albian from 660 to 1,000 ft.

Shell (Queensland) Development Pty. Ltd.

A scout drilling campaign to evaluate a structure a few miles north of Somerby Homestead, 42 miles east-south-east of Springsure, was begun on 19th January, 1948. Nine holes were drilled with a Failing 2500 rotary plant. A south-plunging nose was found, and the campaign was abandoned on 11th July, 1948.

The rig was transferred to the Warrinilla area, where a scout drilling campaign to investigate an anticlinal zone was begun on 20th July, 1948. The company drilled 28 holes with the Failing rig, and contractors drilled 9 holes with a cable-tool rig. The results obtained were reported to be rather disappointing, and the campaign was stopped on 31st May, 1949.

Scout drilling was begun on the Morella structure on 5th June, 1949. The company drilled 22 holes with the Failing rig, and 8 by cable-tool. Contractors drilled 2 holes by cable-tool. The area of culmination was defined, and sufficient information obtained to choose the location for a deep test. The work was completed on 9th September, 1949.

S.Q.D. No. 1 (Morella) (Fig. 14)

This well is located at lat. 25° 00′ 46″ S.; long. 148° 29′ 04″ E. Surface elevation is 950 ft. and rotary table elevation was 965 ft. The rig used was a National Ideal 100.

Drilling began on 30th April, 1950, and total depth, 4,634 ft., was reached on 21st January, 1951.

The strata penetrated were:

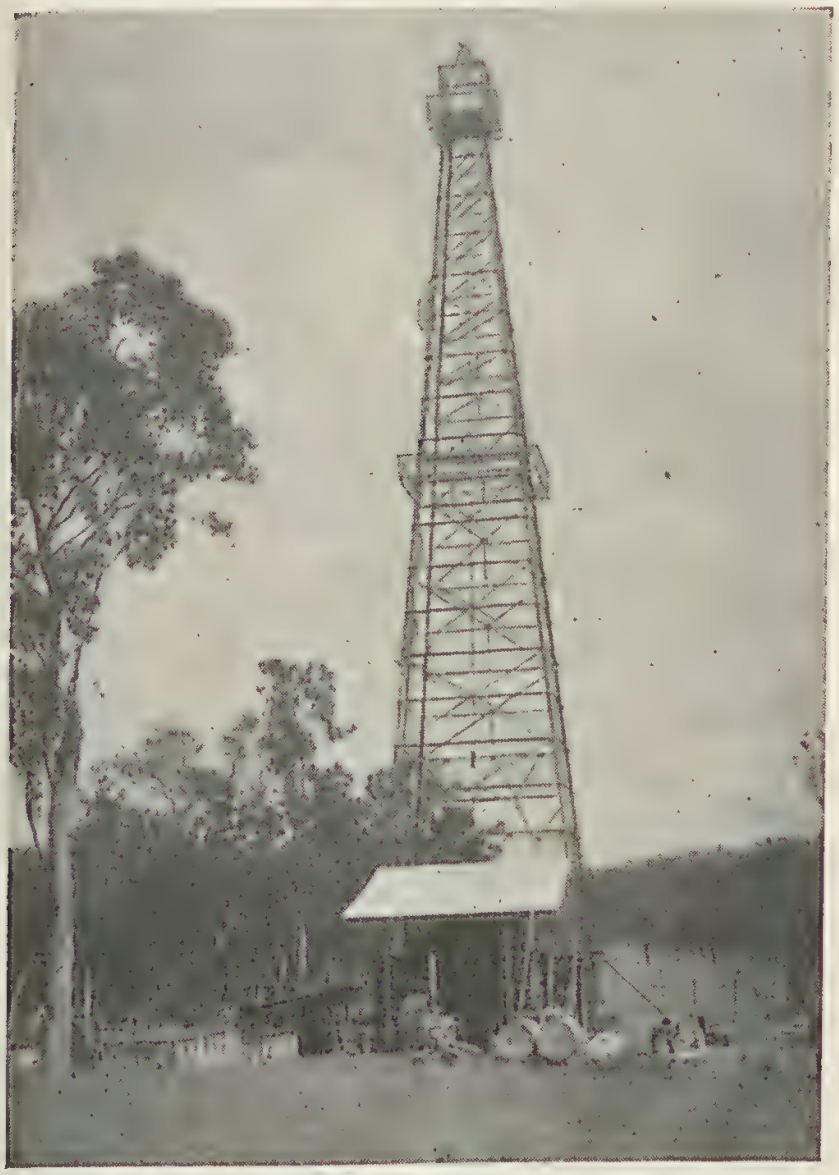
0– 793 ft.	Rewan Formation
793–1,590 ft.	Bandanna Formation
1,590–2,080 ft.	Catherine Sandstone
2,080–2,691 ft.	Ingelara Beds
2,691–3,880 ft.	Aldebaran Sandstone
3,880–4,361 ft.	Cattle Creek Formation
4.361–4,363 ft.	Basal conglomerate
4,363–4,634 ft.	Igneous basement

No gas or water shows were logged. Traces of oil were detected at about 3,000 ft. A Schlumberger electric log was recorded over the entire well, and the most promising resistivity variation, though weak, was tested.

Cores were taken at an average of one per 100 ft. from 1,480 ft. to bottom; all showed low dips.

A 16 in. diam. conductor box was cemented at 22 ft., 14¾ in. hole was drilled to 1,505 ft. and 10¾ in. A.P.I. 55½ lb. was cemented with 750 sacks of cement, 1·85 sp. gr. slurry, at this depth. A 9½ in. hole was drilled to bottom.

To test the best Schlumberger log prospect between 3,100 ft. and 3,125 ft., a cement plug was set between 3,132 ft. and 3,250 ft. and 4½ in. casing with a left-hand joint 200 ft. above the shoe was cemented at 3,094 ft. with 150 ft. of cement behind the casing.



S.O.D. No. 1 (Morella). Drilling in progress with a National 100 rig.

The casing and cementing were tested, the drilling mud displaced by water and the walls of the open hole cleaned of mud cake. Tubing was run to 3,074 ft. and the hole swabbed. The fluid level was reduced to 2,900 ft. and some slightly saline water entered the hole, but after five days' swabbing and standing there was no production. The tubing was lowered to 3,132 ft. and all fluid in the hole displaced by mud, that from the bottom being water containing 600 milligrams per litre of chloride and a small amount of inflammable gas as indicated by a gas detector.

The well was abandoned by backing off the 4½ in. casing at the left-hand joint at 2,891 ft. and withdrawing it, placing a cement plug from 1,470 ft. to 1,535 ft. about the shoe of the 10¾ in. casing and welding a steel pipe, filled with cement, to the top of the 10¾ in. casing to which a plate, recording the name of the well, was attached.

Standard Gas Pty. Ltd. Scout Bore No. 1 (Cribb Island)

This bore was drilled at Cribb Island, a bayside suburb 10 miles north-east of Brisbane, to test for a reported showing of oil and methane in a water bore (Jackson's Bore) put down on Jackson's Estate, Cribb Island, in 1920 (Table I). The location is on tidal land approximately 3,500 ft. bearing 132° true from Jackson's Bore, which is located 776 ft. bearing 297° true from Cribb Island Post Office. The site was built up to a height of about 3 ft. S.G.P. Scout Bore No. 1 was drilled with a small percussion plant. It was spudded in on 2nd October, 1957, and reached final depth of 480 ft. on 26th February, 1958. The bore penetrated clay, sand and gravel (Quaternary?) to 130 ft., and shale, sandstone and basalt (Tertiary?) from 130 ft. to 480 ft.

Chloroform extraction of sludge from 406 ft. gave up to 2 per cent. of brown mineral oil of the consistency of vaseline. This could be attributed to contamination by drilling lubricants.

Bubbles of odourless inflammable gas were reported to have been seen in sludge from 190 ft.; analyses of this sludge for gas and mineral oil gave negative results.

Highly saline water (Table V) was met in gravel from 90 ft. to 118 ft.

S.G.P. Scout Bore No. 2 (Cribb Island)

This bore also was drilled to test for a reported showing of oil and methane in the water-bore drilled on Jackson's Estate, Cribb Island, in 1920. It is located 71 ft. bearing 340° true from Jackson's Bore; surface elevation is about 2 ft. above high water mark. The rig was a small percussion unit. Drilling began on 23rd April, 1958, and final depth of 222 ft. was reached on 22nd May, 1958. The section penetrated is believed to be similar to that met in S.G.P. Scout Bores Nos. 9 and 10 (see below).

No shows of oil or gas were met.

S.G.P. Scout Bore No. 3 (Pinkenba)

This bore was drilled on a divined site on Zigenbine's Farm, Harris Street, Pinkenba, a suburb 7 miles east-north-east of Brisbane. Surface elevation was about 15 ft. The driller was L. R. Abbott, and the rig an Hydromaster percussion unit. Drilling began on 27th May, 1958. Eight inch casing was run to 154 ft., 6 in. casing to 380 ft., and 5 in. casing to 429 ft. The 5 in. casing was later pulled to 357 ft. Drilling finished on 11th August, 1958, at 450 ft. in siltstone with shell fragments of riverine type (Cainozoic?).

No oil or gas shows were met.

S.G.P. Scout Bore No. 4 (Gumdale)

This bore was drilled on a divined site on N. Arundell's property at the corner of Molle Street and Drury Road, Gumdale, a suburb 9 miles east-south-east of Brisbane. Surface elevation of the site is about 15 ft. The driller was W. Dance, and the rig a Southern Cross No. 2 percussion plant. The bore was put down to 120 ft. by N. Arundell, with the help of S. Greene of Wynnum, and was taken over by Standard Gas Pty. Ltd. in July 1958, and deepened to 300 ft. The bore was abandoned on 30th September, 1958. The strata penetrated were mainly mudstone and sandstone (Tertiary?). Several oil and gas shows were reported, but were not confirmed.

S.G.P. Scout Bore No. 5 (Gumdale)

This bore was drilled on Marshall's property at Arenga Street (formerly Progress Street), Gumdale, to test for gas met at about 210 ft. in a water bore drilled on the property about ten years previously. Surface elevation is about 70 ft. The driller was R. C. Abbott, and the drill a rebuilt Armstrong percussion plant. Drilling began on 13th October, 1958, and final depth of 460 ft. was reached on 10th December, 1958. Six inch casing was run to 324 ft., and was withdrawn before the hole was abandoned. The strata penetrated were reported to be sandstone, shale and coal (probably equivalent Ipswich Coal Measures).

No oil was met. There was a slight show of gas at about 350 ft.

S.G.P. Scout Bore No. 6 (Gumdale)

This bore was drilled on a divined site 300 ft. east-south-east of S.G.P. Scout Bore No. 5, with the same intention, of testing for a show of gas met in a nearby water-bore. Elevation of the site was about 90 ft. The driller was R. C. Abbott, and the rig a rebuilt Armstrong percussion plant. Drilling began on the 3rd February, 1959, and ceased at a total depth of 288 ft. on the 25th February, 1959. Six inch casing was run to a depth of 170 ft. The sediments penetrated consisted of shale and sandstone with occasional fragments of coal; they are probably equivalent to Ipswich Coal Measures.

No oil or gas shows were met.

S.G.P. Scout Bore No. 7 (Cribb Island)

This scout bore was drilled on a divined site 377 ft. bearing 235° true from Jackson's Bore, Cribb Island, to test for a reported showing of methane and oil in Jackson's Bore. Surface elevation was 1 ft. above high-water mark. The driller was R. C. Abbott and the drill a rebuilt Armstrong percussion plant. Drilling began on 24th March, 1959, and the hole was abandoned at a depth of 235 ft. on 17th April, 1959. Casing was run to 205 ft. and later withdrawn.

The strata penetrated were:

10– 85 ft.	Soil and grey clay with Recent shell fragments.
90–150 ft.	Sand and gravel, with basalt fragments from 130 to 150 feet.
155–235 ft.	Basalt with calcite and chalcedony in places.

Brine met in gravel at approximately 120 ft. was found to contain 7·0 grams per 100 mls chloride (as sodium chloride), this being about twice the salinity of sea water.

Reports of shows of oil were not substantiated.

Gas shows were reported at depths of about 150 ft. and about 235 ft. The amount present was insufficient for analysis.

S.G.P. Scout Bore No. 8 (Cribb Island)

This bore was located 574 ft. bearing 246° true from Jackson's Bore, with the aim of testing for oil or gas below the hard basalt met at 230 ft. in S.G.P. Scout Bore No. 7. Surface elevation was about 1 ft. above high water mark. The driller was R. C. Abbott, and the rig a rebuilt Armstrong percussion plant. Drilling began on 24th April, 1959, and ceased on 13th June, 1959, at a total depth of 362 ft. Six inch casing was run to 100 ft. and 5 in. casing to 324 ft.

The strata penetrated were:

0– 35 ft.	Sand and argillaceous sand, with Recent shell fragments (pelecypods).
40– 75 ft.	Greenish-grey clay.
75–115 ft.	Light-brown arenaceous clay.
120–140 ft.	Decomposed basalt (? basaltic soil).
145–300 ft.	Basalt and basaltic clay (? halloysitic) with probably a bed of sandstone at about 250 feet.
300–330 ft.	Light-grey sandstone with limestone fragments.
335–360 ft.	Greenish-grey mudstone with limestone fragments.

The section from 0 ft. to 115 ft. is probably of Quaternary age, and that from 120 ft. to 360 ft. is probably of Tertiary age.

Brine was met at about 75 ft., and fresh water at about 235 ft.

A slight show of oil at about 300 ft. was reported, but not confirmed. No gas shows were reported.

S.G.P. Scout Bore No. 9 (Cribb Island)

This bore was located on a divined site 35 ft. bearing 212° true from Jackson's Bore to test for reported oil and gas showings in that bore. Surface elevation is about 2 ft. above high water mark. The driller was R. C. Abbott, and the rig was a rebuilt Armstrong percussion plant. Drilling began on

16th June, 1959, and final depth of 249 ft. was reached on 29th July, 1959. Six inch casing was run to a depth of 212 ft. and withdrawn on completion of the bore.

The strata penetrated consisted of:—

5– 15 ft.	Argillaceous sand.
20– 80 ft.	Mud and silt with *Mactra* sp., and lignified wood fragments in places.
85–130 ft.	Sand and gravel.
135–249 ft.	Basalt and decomposed basalt.

Brine was met in sand between 85 and 130 ft.

No oil or gas shows were recorded.

S.G.P. Scout Bore No. 10 (Cribb Island)

This bore was located on a divined site 96 ft. bearing 72° true from Jackson's Bore. It was drilled to test for a showing of oil and gas met in Jackson's Bore. Surface elevation is about 2 ft. above high water mark. The driller was R. C. Abbott, and the rig a rebuilt Armstrong percussion unit. Drilling began on 27th August, 1959, and total depth of 245 ft. was reached on 12th September, 1959. Casing was run to 145 ft. and withdrawn on completion. The strata penetrated were:—

0- 25 ft.	Sand with shell fragments.
30– 90 ft.	Silt and mud with shell fragments
95–136 ft.	Sand and gravel.
136–245 ft.	Basalt.

Brine was met in sand from 95 ft. to 135 ft. No oil or gas shows were recorded.

Stewart's Mooga N.L. No. 1 (Mooga)

This well is situated at the head of Mooga Mooga Creek, 23 miles north-north-east of Roma, on portion 5, parish of Whithu. Surface elevation is 1,298 ft.

The well was drilled by Intercolonial Boring Co. using a rotary plant. Drilling commenced on 25th July, 1928, and total depth, 3,567 ft., was reached on 17th April, 1930.

Walloon Coal Measures were penetrated from surface to 1,470 ft., Bundamba Group to 2,105 ft., Moolayember Shale and older sediments to 3,533 ft. Metamorphic basement (quartzite and slate with quartz veining) was penetrated to 3,567 ft., according to Dr. H. I. Jensen. However, L. C. Ball considered that metamorphic basement was reached at 3,220 ft. There is no evidence recorded to correlate the lower sediments with surface exposures, but comparison with the log of A.R.O. No. 7 nearby suggests that the brown and black shale with coal from 3,200 ft. to bedrock, is equivalent Bandanna Formation.

Gas was recorded at 280 ft. in a 10 ft. coal seam, at 685 ft. (reported as having a petroliferous odour), at 760 ft. and 840 ft. (analysed as methane). Oil scum was recorded at 1,589 ft. Water occurred at 1,470 ft., 1,630 ft., 1,680 ft.–1,740 ft., 1,800 ft., 2,100 ft., 2,810 ft. and 2,910 ft.

Twelve inch casing was seated at 104 ft., 8⅝ in. cemented at 1,392 ft. and 6⅝ in. casing followed the bit. The well was tested at 1,600 ft. and, except in the water zones, the fluid level was kept low in the hole while drilling. It is unlikely that any gas or oil shows were overlooked.

The well was abandoned and 6⅝ in. casing withdrawn.

L. H. Smart Oil Exploration Co. Pty. Ltd. Scout Bore No. 1 (Ray)

This scout bore is located at approximately lat. 26° 7′ 25″ S., long. 143° 53′ 35″ E., on Ray Station, about 50 miles north-west of Quilpie. Surface elevation is about 650 ft. The bore was drilled to test a reported occurrence of grease in a nearby water bore. The driller was D. Daly, and the rig a small percussion plant. Drilling commenced on 5th August, 1957, and finished during November or December 1957, at a depth of 820 ft.

The bore penetrated ferruginous soil and light brown sandstone (Tertiary?) from 0 to 23 ft., and grey shale with minor sandstone and siltstone (Winton Formation) from 30 ft. to 820 ft. Carbonaceous material, coal and plant fragments were plentiful between 145 ft. and 820 ft.

The driller reported bituminous material at 660 ft., and gas at 730 ft. These were not confirmed by analysis.

S.O.E. Scout Bore No. 2 (Canaway Downs)

This scout bore was located on Canaway Downs holding at approximately lat. 26° 0′ 27″ S., long. 143° 57′ 4″ E.; it was drilled to test a gravity high. The surface elevation is approximately 700 ft., and the height of the casing above surface was 2 ft. The bore was drilled by J. R. Robinson, with a small percussion pant. Drilling began on 12th May, 1958, and the hole was abandoned at a depth of 1,575 ft. on 21st January, 1959, due to excessive flow of water met at that depth.

The following strata were penetrated:—

0 ft.	Brown sandy-clay soil.
5– 55 ft.	Fawn- to light-grey siltstone and argillaceous sandstone (Tertiary ?).
60–1,575 ft.	Mainly light-grey and grey siltstone, shale, mudstone and sandstone with some greenish-grey sandstone, calcareous sandstone and mudstone, limestone and pyrite. Coal and carbonised plant fragments occur throughout. (Winton Formation).

Grease was found at 898 ft. and 1,149 ft.; a sample from 898 ft. analysed at the Government Chemical Laboratory was found to contain 46 per cent. brown mineral oil of the consistency of vaseline at room temperature; it fluoresced light blue. Gas shows were reported at 1,147 ft., 1,275 ft., 1,425 ft. and 1,575 ft. Gas from 1,275 ft. analysed at the Government Chemical Laboratory was found to contain 89 per cent. methane and 10 per cent. nitrogen (Table III). Water was met at 245 ft., 407 ft. and 742 ft.; the aquifers were cemented off. Water was again met at a depth of 1,575 ft.; the strong flow necessitated the abandonment of the well.

S.O.E. Scout Bore No. 3 (Gumbla)

This bore was drilled near the Gumbla out-station of the Mt. Margaret Station, at lat. 26° 51′ 59″ S., long. 143° 3′ 44″ E., 19 miles bearing 317° true from Eromanga. It was drilled to test an anticlinal structure inferred from gravimetric and surface geological

evidence. The driller was J. R. Robinson, and the rig a small percussion plant. Drilling began on 14th April, 1959, and the hole was plugged and abandoned on 21st October, 1959, at a depth of 1,835 ft. Six inch casing was set at 1,152 ft., and the first hundred feet of the bore were cemented.

The bore penetrated mainly mudstone, with some sandstone and limestone. *Inoceramus* prisms were found at 1,290 ft.; foraminifera and shell fragments were found at and below 1,400 ft. The beds below 1,400 ft. were correlated with the Tambo Formation and those above 1,400 ft., which contained plant fragments and coal, with the Winton Formation.

A viscous brown grease recorded from a depth of 1,155 ft. was analysed at the Government Chemical Laboratory; on chloroform extract it gave 74 per cent. brown mineral oil of the consistency of vaseline, which fluoresced lilac. Gas shows were recorded by the driller at 560 ft., 700–705 ft., 803–805 ft., 945–948 ft., 1,118 ft., 1,152 ft., 1,321–1,325 ft. and 1,818 ft. Gas samples from 700 ft., 803 ft., 945 ft., 1,146 ft., 1,155 ft. and 1,835 ft. were analysed at the Government Chemical Laboratory and samples from 560 ft., 700 ft., 945 ft., 1,164 ft. and 1,405 ft. were analysed by W. G. C. Sinclair for Geosurveys of Australia Ltd. These gas samples were found to contain up to 75 per cent. hydrogen, as well as methane and inert gases. Water was met from 1,066 to 1,093 ft.

Apparent dips of up to 7° were recorded at 1,285 ft. and 1,432 ft.

South Pacific Pty. Ltd. No. 1 (Birkhead) (Fig. 13)

This well is situated at lat. 24° 36′ 34″ S., long. 146° 23′ 27″ E., adjacent to the Mitchell Highway, 21·6 miles north of Tambo, in portion 6, parish of Cathay, county of Bulgroo. It was spudded-in on 28th April, 1957, and abandoned as a dry hole at 5,186 ft. on 20th June, 1957. The reduced level of the ground surface at the well site is 1,556 ft. and rotary table elevation was 1,570 ft. The well was drilled by Oil Drilling and Exploration Ltd. with a National 80B rig.

The purpose of the well was to test the oil possibilities of the Permain freshwater sedimentary section in a slightly plunging broad anticline deduced from photogeological work. E. A. Webb summarised the section as: Surface to 1,250 ft., Marburg Sandstone and Bundamba Group; 1,250 ft.–2,260 ft., Cheshire Formation (1,010 ft.), consisting of green and brown freshwater silty shale; 2,260 ft. to 4,460 ft., Colinlea Formation (2,200 ft.), consisting of sandstone, grit and conglomerate with a shale member from 3,120 ft. to 3,210 ft.; 4,460 ft. to 5,000 ft. (progress depth), Joe Joe Formation, consisting of shale and siltstone.

The shale and siltstone continued to 5,040 ft., at which depth the well site geologist, M. Grissett, reported an apparent angular unconformity, considered to indicate the base of the Permian succession. Indurated shale and siltstone with dips of up to 40° were reported from 5,040 ft. to total depth (5,186 ft.). A 6 in. length of core from between 5,135 ft. and 5,141 ft., examined at the Geological Survey, showed dips of 25°. A thin section showed that the shale was calcareous and unmetamorphosed. Carbonised plant remains were found on bedding planes in the core, and one fragment was recognised as part of a leaf, the venation of which was suggestive of *Gangamopteris* or *Glossopteris*. This indicates that the formation in which the well bottomed was probably of Permo-Carboniferous age and certainly not older than Carboniferous. With the exception of the plant remains mentioned, no fossils were obtained from the five core samples taken at 926 ft.–941 ft., 2,626 ft.–2,646 ft., 2,971 ft.–2,972½ ft., 3,600 ft.–3,617 ft. and 5,135 ft.–5,141 ft.

A gas show was met at 3,600 ft., but a packer test gave a negative result. A gas detector-recorder and automatic penetration rate-meter were used throughout drilling operations. An electric log and microlog were taken on the completion of the well.

Surface casing (outside diameter 13⅜ in.) was seated at a depth of 502 ft. Drilling was continued using a 8¾-in. diameter bit. The well was plugged with cement at 3,000 ft., 1,500 ft., 502 ft. and at the surface after the hole was abandoned at a depth of 5,186 ft.

Tambo Oil Sydnicate

See Malta Oil Co. No. 1 (Nive River).

Tewantin Petroleum Co.

See Queensland Coastal Oil Concession.

W. C. Walz Scout Bores Nos. 1-3 (Plevna)

These three scout bores were drilled for W. C. and H. J. Walz at approximately lat. 21° 18′ 57″ S., long. 148° 31′ 36″ E., near Old Plevna Homestead on Hazlewood Creek in the Eungella district, about 44 miles west-south-west of Mackay. The aim was to test the oil possibilities of the Plevna Tertiary oil-shale basin. The driller was A. Faltinsky, and the rig a Southern Cross No. 2 percussion plant. Surface elevation of all three bores was approximately 2,400 ft.

Scout Bore No. 1 was begun on 1st September, 1958, and abandoned at 103 ft. on 22nd September, 1958; it penetrated low grade oil shale to 90 ft., and basalt from 95 ft. to 103 ft.

Scout Bore No. 2 was located about 900 ft. east of No. 1; it was begun on 24th September, 1958, and abandoned at 170 ft. on about 20th October, 1958. The strata were mainly low grade oil shale and some andesite to 118 ft., and mainly andesite, with some basalt, rhyolite and shale from 118 ft. to 170 ft.

Scout Bore No. 3 was located about 800 ft. south-east of No. 2; it was begun on 25th October, 1958, and abandoned at 400 ft. on 3rd December, 1958. The strata were low grade oil shale, siltstone, tuff and andesite to 314 ft., and basalt from 314 ft. to 400 ft.

Wellington Point Oil Wells Ltd. No. 1 (Birkdale)

This well was located by divination 15 chains north-east of Birkdale railway station, at the south end of subdivision 1, portion 29, parish of Capalaba. Surface elevation is 15 ft. Drilling with percussion plant began in November 1930, and reached 3,950 ft. in 1934.

Basalt was penetrated from surface to 982 ft., Mesozoic sediments to 3,500 ft., and schist to total depth, 3,950 ft. The upper 400 ft. of Mesozoic sediments consisted of sandstone with carbonaceous material, possibly equivalent Bundamba Group. The underlying sediments, possibly equivalent Ipswich Coal Measures, were coaly at 1,420 ft. and 3,030 ft. A bed of coarse sandstone at 2,162 ft. was claimed to have absorbed water at the rate of 50 gallons per day.

Small shows of gas were recorded at 1,150 ft., 1,565 ft., 1,815 ft. and 2,614 ft. Gas from 1,565 ft. analysed 50 per cent. methane and 34 per cent. hydrogen. Gas from 1,650 ft. analysed 50·7 per cent. methane and 28·0 per cent. hydrogen (Table III).

Oil was recorded at 1,450 ft., 1,565 ft. and 2,230 ft., as films and emulsions.

Water in good supply was met at 20 ft. and 70 ft. in the basalt. Saline waters at 2,234 ft. and 3,530 ft. (?) were analysed (Table V.)

Bailing tests were made with bottom at 1,815 ft. and again with open hole from 2,050 ft. to 2,175 ft. Both tests failed to give production.

The well penetrated the following strata:

Surface to 1,406 ft.	Winton Formation :	alternating light grey shale and fine argillaceous sandstone, with some carbonaceous bands
1,406–2,196 ft.	Tambo Formation :	light blue-grey shale
2,196–2,951 ft.	Roma Formation :	blue-grey shale with greenish (glauconitic?) bands
2,951–4,050 ft.	Blythesdale Group :	fine to medium grained sandstone with some brown shaley bands and few plant fragments
4,050 to about 4,150 ft.	Walloon Coal Measures :	shale
4,150–5,054 ft.	Bundamba Group :	medium to coarse porous sandstone with some bands of dark shale
5,054–5,399 ft.	Drummond Group? :	multi-coloured shale, dipping at 60°
5,399–5,430 ft.	granite	

The Blythesdale Group (2,951–4,050 ft.) was subdivided into :

2,951–3,291 ft.	" Transition Stage "
3,291–3,608 ft.	Mooga Sandstone
3,608–3,686 ft.	" Fossil Wood Stage "
3,686–4,050 ft.	Gubberamunda Sandstone

The Bundamba Group (4,150–5,054 ft.) was subdivided into :

4,160–4,280 ft.	Boxvale Sandstone
4,280–4,600 ft.	Evergreen Shale
4,600–5,054 ft.	Precipice Sandstone

Porous sandstones were cored, and cores were taken also at 500 ft. intervals. No electric logs were run. No show of oil was met, and the well was abandoned as a dry hole.

Westland Oil Co. Ltd.

In 1955 this company drilled three wells on Warbreccan Station, approximately 110 miles south-west of Longreach. The wells were all situated near the old Warbreccan flowing bore, from which samples of wet gas had been taken in 1928. Geological surveys in the area and bore-log correlations, suggest that the wells may be situated somewhere about the crest of a broad structural ridge, which extends roughly south-west from Longreach. The width of this broad fold is not known, but to the east there lies a deeper basin centred about the Springleigh bore and the Barcoo River region; and to the west is a deep basin in the region of the Diamantina River. However, in the Warbreccan area the Mesozoic strata are almost perfectly horizontal.

All three wells were drilled under contract by Petroleum Drilling Corporation using a Wagner-Moorehouse rotary plant.

W.O.L. No. 1 (Warbreccan) (Fig. 15)

This well is situated 13 miles 77·6 chains bearing 201° 31′ from the intersection point of the parishes of Beatrice, Senex and Thomas; lat. 24° 25′ 45″ S., long. 142° 46′ 30″ E. Rotary table elevation was 770 ft. above sea level, and 9 ft. above surface. Drilling began on the 28th January, 1955, and was completed on the 23rd March, 1955, at a total depth of 5,430 ft.

W.O.L. No. 2 (Warbreccan) (Fig. 15)

This well is located 47·7 chains bearing 33° from the old Warbreccan flowing bore, which is located at lat. 24° 25′ 40″ S., long. 142° 46′ 40″ E. It is approximately 1 mile north-east of W.O.L. No. 1. Ground level at the site is 773 ft. above sea level, and rotary table elevation, from which all depths were measured, was 782 ft. The well was spudded in on 3rd April, 1955, and was abandoned as a dry hole at a depth of 5,224 ft. on 7th June, 1955.

From surface to 1,430 ft., lithology consists of alternating sandstone and shale of the Winton Formation. The sandstone is fine grained and well cemented, and dominates the section. Aquifers occur between 395 ft. and 415 ft., 575 ft. and 600 ft., and 1,270 ft. and 1,300 ft. The transition to the underlying Tambo Formation is gradual but has been placed at 1,430 ft.

Impervious beds of the Tambo and Roma Formations occur between 1,430 ft. and 3,100 ft. The division between these two formations is uncertain, but has been placed tentatively at 2,325 ft. Lithology consists mainly of blue-grey to olive-grey shales with some dark chocolate-brown shales between 2,420 ft. and 2,510 ft. The coquina limestone member of the Roma Formation occurs between 2,375 ft. and 2,410 ft., and shell fragments were found at 2,720 ft. and between 2,925 ft. and 2,970 ft.

The Blythesdale Group between 3,100 ft. and 4,075 ft. consists mainly of soft, white, porous sandstone with subordinate grey, blue-grey and brown shale. The sequence has been sub-divided into the "Transition Stage" from 3,100 ft. to 3,350 ft., Mooga Sandstone to 3,626 ft., the "Fossil Wood Stage" to 3,720 ft. and the Gubberamunda Sandstone to 4,075 ft.

Dark grey shales between 4,075 ft. and 4,194 ft. are correlated with the Walloon Coal Measures. Below these beds is the Bundamba Group from 4,194 ft. to 5,224 ft. (total depth). This group is subdivided into the Boxvale Sandstone from 4,194 ft. to 4,305 ft., the Evergreen Shale to 4,616 ft. and the Precipice Sandstone to 5,224 ft. The Boxvale consists mainly of white fine-grained sandstone with minor grey shale. Porous beds occur in this formation from 4,194 ft. to 4,227 ft. and 4,300 ft. to 4,305 ft. The Evergreen Shale is impervious and grades into the Precipice Sandstone. This latter sandstone contains many porous members interbedded with impervious beds. The final 100 ft. of this well consist of very hard sandstone, which had no equivalent in W.O.L. No. 1.

Cores were taken of porous sandstones, and electric logs were run. No show of oil was obtained, and the well was abandoned as a dry hole.

W.O.L. No. 3 (Warbreccan) (Fig. 15)

This well is situated 3·3 miles bearing 338° from W.O.L. No. 2. Ground level at the site is 665 ft. and rotary table elevation was 673 ft. The well was spudded in on the 23rd June, 1955, and reached total depth of 6,054 ft. on 28th August, 1955.

From surface to 1,294 ft., the well penetrated Winton Formation, consisting of mudstone mainly, with some fine argillaceous sandstone, a little limestone and rare coal. Thin aquifer horizons occur throughout this formation. Below are the impervious beds of the Tambo and Roma Formations between 1,294 ft. and 2,980 ft. The boundary between these two formations is not sharp but has been placed at 2,200 ft. The Tambo Formation consists of pale grey compact shale with occasional shell fragments. The underlying Roma Formation consists of darker blue-grey to dark grey calcareous shale, with a few green glauconitic(?) bands. In places the shale is pyritic. The coquinite, which was also found in W.O.L. No. 1 and W.O.L. No. 2, occurs between 2,250 ft. and 2,280 ft.

The Blythesdale Group between 2,980 ft. and 3,933 ft. has been subdivided into the "Transition Stage", 2,980 ft. to 3,208 ft.; Mooga Sandstone 3,208 ft. to 3,496 ft.; "Fossil Wood Stage" 3,496 ft. to 3,602 ft., and the Gubberamunda Sandstone to 3,933 ft.

Below the Blythesdale Group is a bed of shale (3,933 ft. to 4,043 ft.) which, as in the two previous wells, is correlated tentatively with the Walloon Coal Measures.

The Bundamba Group (4,043 ft. to 5,160 ft.) is divided into the Boxvale Sandstone (4,043 ft. to 4,160 ft.), Evergreen Shale (4,160 ft. to 4,503 ft.), and the Precipice Standstone (4,503 ft. to 5,160 ft.). The Boxvale Sandstone is a porous formation, with the porosity greater in the basal half of the formation. The Evergreen Shale is impervious and caps the porous Precipice Sandstone. In this formation the top 300 ft. is fairly consistently porous and the next 130 ft. has thicker shale bands (up to 30 ft. thick) separating good aquifer horizons.

Below the Precipice Sandstone, between 5,160 ft. and 5,263 ft., are two formations, an upper porous sandstone horizon and a lower shale sequence which is in part coaly. The sandstone which is lithologically different from the Precipice Sandstone, is horizontal, unfossiliferous and of unknown age. It was not found in W.O.L. No. 1 between the basal Bundamba and the underlying Drummond(?) beds. Elsewhere in Queensland where the Precipice Sandstone is found, it rests unconformably on older formations. To the north of Roma, Clematis Sandstone and Moolayember Shale (Triassic) are found below the Precipice Sandstone, whereas in the Hughenden district Permian beds occur directly below the Precipice Sandstone. For this reason the sequence is stated to be "Permo-Triassic."

Underlying these "Permo-Triassic" beds are highly tilted compact sediments dipping at about 60°. They consist of sandstone and shale, considerably sheared, and containing some highly coloured members—chocolate, bright green, reds, etc. On lithological grounds they have been correlated with the Drummond Group of sediments of Carboniferous age which outcrop to the east along the margin of the Artesian Basin between Pentland and Tambo. The bore bottomed in these beds at 6,054 ft.

The age of the steeply dipping shales met with in W.O.L. No. 1 and W.O.L. No. 3 remains uncertain. Previously in some of the deeper water bores drilled in this part of the Great Artesian Basin, multi-coloured shales have been recorded as basement and assigned tentatively to the Permian. However, although on lithological grounds correlation with the Drummond Group is reasonable, multi-coloured beds of a similar lithology also occur in the Devonian to the west of Springsure, so that the most that can be said of the beds is that they are probably of Upper Palaeozoic age. It is assumed that the folded beds rest on a very irregular basement of granite rather than that the granite is intrusive into them.

Cores were taken of porous sandstones, and electric logs were run. No authentic show of oil was met. Some sandstones showed traces of light oil, which on analysis at the Government Chemical Laboratory was proved to be a refined oil of dieseline-like consistency, from the oil-base drilling mud. The well was abandoned as a dry hole.

Winneills Pty. Ltd.

In the period 1953 to 1957, bores were drilled for this company in seven areas in south-eastern Queensland. Shallow scout bores were sunk at Mount Walker, Mount Forbes, Coopers Plains, Brigalow, Cameby, Bald Hills and Noosa, to test for reported occurrences of gas and/or oil in water bores and/or seepages. Methane was met in the Mount Walker bores, but

otherwise no confirmed showings of gas or oil were obtained. A deep test well drilled at Wellington Point in 1955 did not meet any indications of oil or gas.

W.P.L. Scout Bores Nos. 1-10 (Mount Walker)

These ten scout bores, also known as Christensen's Nos. 1-10, were drilled in the Mount Walker area, south-west of Ipswich, in 1953 to 1955. Nine were located on portion 32, parish of Mutdapilly, county of Churchill, and the other in portion 17, parish of Forbes. Percussion plant was used.

The driller's logs record shale, sandstone, thin coal seams, and basalt. The sediments are probably Walloon Coal Measures, and the volcanics are probably the flows or sills known in this area.

Small quantities of dry gas were met in six of the ten holes, at depths ranging from 129 ft. to 132 ft. Analysis showed the gas to consist almost entirely of methane.

The depths of the holes were:

	ft.	
No. 1	300	(gas)
No. 2	352	(gas)
No. 3	186	(gas)
No. 4	356	
No. 5	286	(gas)
No. 6	193	(gas)
No. 7	207	(gas)
No. 8	282	
No. 9	380	
No. 10	353	

All the bores were abandoned.

W.P.L. Scout Bores Nos. 1-4 (Mount Forbes)

These four scout bores, also known as Griffith's Nos. 1-4, were drilled with percussion plant on portion 185, parish of Mutdapilly, about 3 miles north-east of W.P.L. Scout Bores Nos. 1-10 (Mount Walker), in 1955 to 1956. The strata penetrated were similar to those met in the Mount Walker bores, but no gas was met. The depths of the bores were:

	ft.
No. 1	364
No. 2	207
No. 3	114
No. 4	174

All the bores were abandoned.

W.P.L. Scout Bore No. 1 (Normanby)

One bore was put down on portion 1, parish of Normanby, county of Churchill, 6 miles east-south-east of the Mount Walker bores, to test for the source of an oily scum seen in the creek a few yards away. The bore was abandoned at 112 ft. because of a strong influx of water.

W.P.L. Scout Bore No. 1 (Coopers Plains)

This bore is located near the corner of Beaudesert and Boundary Roads, Coopers Plains, Brisbane. It was drilled by R. C. Abbott, with a small percussion plant, between 5th and 17th July, 1954. Tertiary basalt was met to 141 ft., and sandstone of the Redbank Plains Formation to total depth of 152 ft. No oil or gas was met, and the bore was abandoned.

W.P.L. Scout Bore No. 1 (Brigalow)

This bore is located south of Brigalow, in portion 1337, parish of Hunter, county of Derby. It was drilled to test for gas met at 328 ft. in a water bore drilled 50 yards away. The driller was A. J. Moy, and the rig is a small percussion unit. Drilling began in October 1954, and was completed at 324 ft. in December 1954, without meeting gas or oil.

The strata penetrated were unconsolidated post-Tertiary sediments to 50 ft., and Walloon Coal Measures to total depth of 324 ft.

W.P.L. Scout Bore No. 1 (Cameby)

This bore is located in portion 21, parish of Cameby, county of Bulwer, 5 miles north of Rywung siding on the Western Line, between Chinchilla and Miles. It was drilled to test for salt water and oil reported to have been met at 910 ft. to 921 ft. in an old water bore nearby. The driller was A. J. Moy, and the rig a percussion unit. Drilling began on 16th February, 1955, and was completed on 30th March, 1955, at a total depth of 990 ft. No shows of oil were met.

The strata penetrated from surface to total depth were Walloon Coal Measures.

W.P.L. Scout Bores Nos. 1 and 2 (Sunshine Beach)

These two scout bores were drilled at Sunshine Beach, Noosa, 74 miles north-north-east of Brisbane, to determine what lay under the black peaty sand of the coastal swamp. The company wished to discover whether the action of bacteria on carbonaceous matter, under the influence of salt water nearby, had formed oil in this peaty sand of the coastal swamp.

The driller was R. C. Abbott, and the rig a small percussion unit. Drilling of No. 1 bore commenced on 28th March, 1955, and finished at 110 ft. on 31st March, 1955. No. 2 commenced on 2nd April, 1955, and finished at 115 ft. on 5th April, 1955. Both bores penetrated sand only. Neither yielded any trace of oil or gas.

W.P.L. Scout Bore No. 1 (Bald Hills)

This well is located near the north-west corner of portion 224, parish of Nundah, approximately 10 chains south of the South Pine River at Deepwater Bend. Elevation has not been determined but is less than 25 ft. The purpose of boring was to test strata penetrated by an earlier bore from which traces of oil had been reported.

The well was drilled under contract by R. C. Abbott, using a mobile Overall McCray percussion plant. Drilling began on 1st June, 1956, and the hole

was abandoned on 13th March, 1957, as a dry hole at a depth of 650 ft. after a pumping test had failed to show any trace of oil. Diameter of the hole was 8 in.; casing was run to 550 ft.

Unconsolidated clay, sand and gravel of Tertiary or post-Tertiary age were met to 70 ft. From 70 ft. to total depth, the sediments were mainly sandstone of Mesozoic age; the upper part can be correlated definitely with the Brighton Beds (Jurassic).

Traces of oil were recorded by the driller at approximately 500 ft. A sample of sandstone cuttings from 505 ft. gave a negative chloroform test in the Geological Survey laboratory.

The casing was withdrawn, fitted with a sleeve and valve, and with the casing at 495 ft. the well was pumped for 9 hours without any showing of oil or gas. After standing for some hours the well was again tested by pumping, with negative results. The casing was then withdrawn and the well filled in and abandoned.

Winneills Pty. Ltd. No. 1 (Wellington Point) (Fig. 16)

This well was located at lat. 27° 29′ 1″ S., long. 153° 14′ 28″ E., 67 chains bearing 350° from Wellington Point railway station. It was drilled to test the potentialities of the strata in which Wellington Point Oil Wells Ltd. No. 1 (Birkdale), drilled 1½ miles west, in 1934, met oil at 2,230 ft. Rotary table elevation was 16·6 ft. above sea level and 10·4 ft. above ground level at site. The drillers were Oil Drilling and Exploration Ltd., and the rig a National T20 rotary plant. The well was spudded in on 10th July, 1955, and reached total depth of 3,751 ft. on 8th September, 1955.

To 797 ft., the well penetrated basalt and scoriaceous material with some green and red shale; these strata are probably of Tertiary age. From 797 ft. to 3,699 ft., the well penetrated sandstone mainly, with thin bands of shale, bands of coaly material at 1,150 ft. to 1,212 ft. and 3,301 ft. to 3,699 ft., conglomerate at 3,560 ft. The coal at 3,301 ft. was examined at the Geological Survey of Queensland, and found to be of high rank and barren of spores. These beds between 797 ft. and 3,699 ft. are possibly an arenaceous facies of the Ipswich Coal Measures. From 3,699 ft. to total depth 3,751 ft., the well penetrated basement of quartz-veined, pyritic, siliceous argillite, comparable to the Brisbane Metamorphics.

Altogether, 192 ft. of strata were cored between 877 ft. and 3,751 ft.; overall recovery was 98 per cent.

No indications of oil or gas were obtained.

The well was plugged at surface, the casing cut 2 ft. below ground level, and the well abandoned.

Zinc Corporation Ltd. No. 1 (Weipa)

The well is located 4 miles south-east of Weipa Mission Station, at lat. 12° 43′ 00″ S., long. 141° 55′ 50″ E. The rotary table elevation was 50·7 ft. above mean-sea-level, 17 ft. above the surface. The site was chosen on geophysical evidence: 400 ft. west of the crest of a gravity nose, 15 miles long, open to the north-north-east and plunging slightly to the south-south-west.

The well was drilled by Oil Drilling and Exploration Ltd. with a National 55 rotary plant. It was spudded-in on 20th August, 1957. A 17½ in. diameter hole was drilled to 45 ft. and reamed to 30 in. diameter. A 20 in. inside diameter conductor box was set to 45 ft. and cemented to surface. A 12¼ in. diameter hole was drilled to 453 ft. and reamed to 17½ in. diameter. Thirteen and three-eighth inch (48 lb.) casing was run to 453 ft. and cemented to surface. An 8¾ in. diameter hole was drilled to 3,092 ft. and reamed to 2,907 ft. at 12¼ in. diameter. An 8¾ in. diameter pilot hole was drilled to final depth of 3,243 ft. The hole was completed as an artesian water producer by running to 2,896 ft. a string of 9⅝ in. casing, perforated from 2,412 to 2,896 ft. at the rate of 2 x ¼ in. slots per foot. The string was cemented from 2,404 ft. to surface. The date of completion was 12th October, 1957.

Twenty-five cores were taken, sixteen with Hughes J type barrel, one Junk Basket core, and eight sidewall cores. The hole was logged electrically by the drilling contractors; natural potential and resistivity curves were recorded.

The strata penetrated may be divided into:—

Surface–105 ft.	Lynd Formation	Tertiary
105–1,606 ft.	Normanton Formation	Cretaceous
1,606–2,160 ft.	Blackdown Formation	Cretaceous
2,160–2,570 ft.	Wrotham Park Sandstone	Cretaceous
2,570–2,906 ft.	Coal measures	Jurassic ?
2,906–3,243 ft.	Basement	Pre-Jurassic

The Lynd Formation equivalent from surface to 105 ft. consists of red soil, pisolitic bauxite, quartz sandstone and siltstone.

From 105 to 1,606 ft. the section consists largely of grey micaceous and glauconitic siltstones, with minor shale, mudstone and sandstone. Carbonised plant remains occur from 105 to 540 ft. Marine microplankton were found in Core 1 (453–454 ft.) and a micropalaeontological study by the Bureau of Mineral Resources of Core 2 (998–1,005 ft.) revealed foraminifera of Aptian–Albian age. Some of the upper part of this formation may be of fresh water origin, but the entire sequence is included as equivalent to Normanton Formation (see F.B.H. No. 1 (Wyaaba)).

The section from 1,606 to 2,160 ft. consists of shale from 1,606 to 1,998 ft. and of silty sandstone from 1,998 to 2,160 ft. This section is Blackdown Formation equivalent, and its base is determined from electric log data. Microfossils in Core 4 (1,933–1,945 ft.) were examined at the Bureau of Mineral Resources, and a Lower Cretaceous (Albian) age was indicated.

Wrotham Park Sandstone occurs from 2,160 to 2,570 ft., and consists of poorly sorted current bedded micaceous glauconitic quartz and felspathic sandstone.

Coal was present below 2,570 ft., and increased in amount towards basement at 2,906 ft. This section is separated as coal measures of probable Jurassic age.

Basement was penetrated from 2,906 ft. to the total depth of 3,243 ft., and consisted of metamorphosed sediments, composed of quartz, chlorite, muscovite, magnetite and pyrite, with veins containing quartz and pyrite.

No reliable dip evidence was obtained. There were no oil or gas shows. Core extraction tests yielded a few traces of oil, attributed to contamination by drilling lubricants.

Three formation tests were carried out in the interval 2,346–2,723 ft. The strata yielded fresh water under pressure. Production by V notch weir flow was 548,700 gallons per day.

PART 3

TABLES

Table I lists showings of oil and gas, other than in holes drilled for oil or gas, confirmed by analysis. Table II lists showings other than in holes drilled for oil and gas, not confirmed by analysis, but considered to be significant.

The stratigraphic correlation is mainly from drillers' logs and is based primarily on the aquifers and the reported occurrence of brown shale or coal. The Blythesdale and Bundamba Groups are largely arenaceous sediments, in which coal and brown shale are absent or very subordinate, usually carrying artesian water. The Walloon Coal Measures are mainly argillaceous with coal or brown shale. Beneath the Bundamba Group correlation is extremely doubtful, but sediments are generally considered Mesozoic in age if shales are recorded as blue, grey or green in colour with minor coaly or brown shale zones. Where multi-coloured or red shale is recorded the sediments are considered to be of Permian age or older.

Tables III–V list details of gas, oil and water analyses, respectively.

TABLE I

OIL AND GAS SHOWS, OTHER THAN IN HOLES DRILLED FOR OIL AND GAS, CONFIRMED BY ANALYSIS

(Analyses are listed in Tables III and IV)

Name and Locality	Position— Latitude S. Longitude E.	Surface Elevation	Total Depth	Oil or Gas	Stratigraphy
		Ft.	Ft.		
Amby Downs, Muckadilla ..	26° 44′ 148° 08′	900	734	Inert gas	Cretaceous and Blythesdale
Ardrossan No. 2, Bymount	26° 06′ 148° 27′	1,400	508	Methane	Walloon
Ashra Downs, Muttaburra ..	22° 00′ 39″ 144° 00′ 45″	768	2,896	Inert gas, methane..	0–1,630′ Roma 1,630–2,349′ Blythesdale 2,349–2,896′ Permian or Triassic 2,896′ Basement?
Avington, Isisford	24° 04′ 144° 56′	760	3,808	Methane, inert gas..	0–2,685′ Roma 2,685–2,800′ Blythesdale? 2,800–3,500′ Walloon? 3,500-3,808′ Bundamba
Barcaldine No. 1	23° 34′ 145° 22′	817	2,681	Inert gas	No log
Beaudesert, Dunn's Bore ..	27° 59′ 153° 00′	?	85	Oil	Recent alluvium
Bender's, Chinchilla ..	26° 51′ 150° 40′	1,025	450	Methane	Walloon
Beutel's Bore, Brigalow ..	26° 50′ 150° 48′	..	180	Methane	Tertiaries and Walloons. 4′ coal at 128′
Bimerah No. 1, Stonehenge	24° 31′ 30″ 143° 39′ 20″	710	4,860	Methane, carbon dioxide	0–4,110′ Tambo and Roma 4,110–4,860′ Blythesdale, etc. (poor log)
Bimerah No. 2	24° 08′ 143° 35′	590	4,310	Methane, carbon dioxide	0–3,250′ Tambo and Roma 3,250–3,640′ Blythesdale 3,640–3,910′ Walloon 3,910–4,310′ Bundamba
Blackall No. 2	24° 26′ 145° 28′	935	2,590	Inert gas	0–1,486′ Tambo and Roma 1,486–2,149′ Blythesdale 2,149–2,590′ Walloon?
Borah Trust, Surat	27° 03′ 148° 47′	1,096	4,843	Inert gas, methane..	0–120′ Tertiary 120–1,340′ Roma 1,340–1,470′ Blythesdale? 1,470–4,165′ Walloon 4,165–4,600′ Bundamba 4,600–4,843′ Moolayember 4,843′ Basement
Boulia area, 12 miles north of Chatsworth Homestead	21° 46′ 140° 16′	..	Outcrop	Residual oil ..	Pomegranate Lst. (Upper Cambrian)
Boulia area, 4 miles north-west of Chatsworth Homestead	21° 57′ 140° 15′	..	Outcrop	Residual oil ..	Chatsworth Lst. (Upper Cambrian)
Boulia area, Digby Peaks ..	22° 08′ 140° 06′	..	Outcrop	Residual oil ..	Ninmaroo Lst. (Upper Cambrian–Lower Ordovician)
Boulia area, Black Mountain	22° 32′ 140° 17′	..	Outcrop	Residual oil ..	Ninmaroo Lst. (Upper Cambrian–Lower Ordovician)
Brown's Barcaldine ..	23° 34′ 145° 22′	885	400	Inert gas	0–400′ Roma 400′ Top of Blythesdale
Brown's Chinchilla	26° 53′ 150° 36′	1,000	160	Methane	Walloon
Bulgroo, Quilpie (Daly's Bore)	25° 48′ 143° 45′	?	?	Methane, hydrogen	No log

TABLE I—*continued*

OIL AND GAS SHOWS, OTHER THAN IN HOLES DRILLED FOR OIL AND GAS, CONFIRMED BY ANALYSIS
(Analyses are listed in Tables III and IV)

Name and Locality	Position— Latitude S. Longitude E.	Surface Elevation	Total Depth	Oil or Gas	Stratigraphy
		Ft.	Ft.		
Cairnhope No. 2, Stamford	21° 47′ 143° 57′	1,000	2,732	Oil	0–1,540′ Cretaceous 1,540–2,200′ Blythesdale 2,200–2,275′ Greasy brown clay 2,275–2,732′ Walloon or Permian
Captains Mountain (Curtis), Millmerran	27° 55′ 151° 12′	1,700	750	Methane	Blythesdale and Walloon
Charleville Railway Bore ..	26° 24′ 146° 14′ 30″	979	2,590	Inert gas	0–223′ Recent 223–1,278′ Roma 1,278–1,350′ Blythesdale 1,350–2,480′ Walloon 2,480–2,590′ Bundamba
Cleeve Bore, Longreach ..	23° 25′ 144° 24′	720	3,000	Traces of oil ..	0–27′ Recent 27–2,100′ Cretaceous 2,100–2,459′ Blythesdale 2,459–3,000′ Walloon?
Clifford No. 3, Yuleba ..	26° 07′ 149° 22′	..	509	Methane	No log
Cockatoo Spring, Taroom ..	25° 43′ 150° 17′	?	Surface	Methane	Bundamba Group
Cowley Downs, Quilpie ..	26° 47′ 144° 48′	835	2,748	Inert gas and hydrogen	0–150′ Recent 150–2,147′ Cretaceous 2,147–2,344′ Blythesdale 2,344–2,624′ Walloon 2,624–2,748′ Bundamba
Cribb Island, Jackson's Estate	27° 21′ 153° 08′	2	..	Petrolene, methane	..
Daniels No. 4, Emerald ..	23° 20′ 148° 34′	680	415	Methane	Permian
Elderslie No. 1, Winton ..	22° 00′ 142° 13′	725	3,500	3·5% Ethane .. 66% Inert gas ..	No log
Enniskillen No. 2, Tambo ..	24° 43′ 146° 02′	1,224	2,300	Inert gas	No details
Eromanga No. 1	26° 40′ 35″ 143° 15′ 50″	600 (approx.)	2,621	Methane, inert gas..	0–175′ Tertiary or Recent 175–2,621′ Cretaceous
Eromanga No. 2	26° 40′ 15″ 143° 16′	600 (approx.)	4,270	Carbon dioxide, methane	0–215′ Tertiary or Recent 215–3,100′ Cretaceous 3,100–4,230′ Blythesdale and/or Walloon 4,230–4,270′ Bundamba or Permian
Evesham No. 1, Longreach..	22° 59′ 35″ 143° 34′	750?	4,150	4,100′ (approx.) ..	0–3,031′ Cretaceous 3,031–3,241′ Hot flow water in shales; fault zone? 3,241–4,150′ Permian?
Gartmore, Tambo	24° 46′ 146° 13′	1,230	2,418	Inert gas	0–710′ Cretaceous 710–960′ Blythesdale? 960–2,160′ Walloon 2,160–2,418′ Bundamba
Hascombe, Isisford	24° 13′ 144° 44′	760	4,548	Inert gas, methane..	0–3,420′ Cretaceous 3,420–3,560′ Blythesdale 3,560–3,782′ Walloon 3,782–4,060′ Bundamba 4,060–4,270′ Moolayember 4,270–4,548′ Permian

TABLE I—*continued*

OIL AND GAS SHOWS, OTHER THAN IN HOLES DRILLED FOR OIL AND GAS, CONFIRMED BY ANALYSIS

(Analyses are listed in Tables III and IV)

Name and Locality	Position—Latitude S. Longitude E.	Surface Elevation	Total Depth	Oil or Gas	Stratigraphy
		Ft.	Ft.		
Hopeland Trust, Surat ..	27° 08′ 30″ 148° 20′	970	4,492	3,876′ inflammable 4,255′ inert gas, oil and wax reported	0–200′ Tertiary 200–1,450′ Roma 1,450–1,600′ Blythesdale 1,600–3,830′ Walloon 3,830–4,370′ Bundamba 4,370–4,470′ Moolayember 4,470–4,492′ Metamorphics
Ilfracombe	23° 29′ 20″ 144° 30′ 45″	710	2,450	Methane	No log
Injune Town Bore	25° 51′ 148° 33′	1,274	1,354	Trace oil 275–279′ ..	Jurassics
Innot Hot Spring, Mount Garnet	17° 38′ 145° 13′	?	Spring	Inert gas	Palaeozoic slate
Inverleigh West, Normanton	18° 10′ 139° 55′	40	2,240	Oil, gas reported ..	0–2,000′ Cretaceous 2,000–2,240′ Blythesdale
Julia Creek	20° 40′ 10″ 141° 44′ 35″	410	1,121	Inert gas	0–966′ Cretaceous 966–1,121′ Blythesdale
Katnock, Oxton Downs, Julia Creek	20° 33′ 141° 55′	468	1,076	Inert gas	0–800′ Tambo 800–1,076′ Granite
Kaywanna Trust, Talwood..	28° 10′ 149° 40′	756	4,341	Methane 3,345′ Oil reported	0–2,600′ Tertiary and Winton 2,600–2,849′ Roma 2,849–3,143′ Blythesdale 3,143–3,386′ Walloon 3,386–3,591′ Bundamba? 3,591–3,990′ Moolayember? 3,990′ reported basement but may be conglomerate as log shows sediments to 4,341′ with water at 4,095′ and 3,273′ (Permian?)
Knockaninny, Barcaldine ..	23° 37′ 145° 18′	850	2,180	Oil 2,176′, wax reported	0–800′ Cretaceous? 800–2,000′ Blythesdale? etc. (No log)
Longreach No. 2	23° 26′ 35″ 144° 14′ 45″	620	3,298	2,470′,3,298′ methane, 3,230′ wax	0–2,330′ Cretaceous 2,330–2,580′ Blythesdale 2,580–3,268′ Walloon? 3,268–3,298′ Granite
Lowood No. 2	27° 28′ 152° 35′	100?	320	Methane	Bundamba
Lynfield No. 2, Yaraka ..	25° 13′ 50″ 143° 50′ 20″	?	777	Methane	Winton
Macfarlane Downs, Tambo..	24° 49′ 145° 57′ 30″	1,310	3,095	Inert gas	No log
Male's Well, Tara	27° 12′ 150° 26′	1,050	235	Traces of oil ..	Late Tertiary?
Manfred No. 1, Longreach ..	23° 04′ 143° 57′ 40″	795	3,870	Inert gas and carbon dioxide	No log
Maria Creek, Comet ..	23° 36′ 30″ 148° 38′ 40″	550	1,000	Carbon dioxide ..	Middle Bowen
Marie Vale, Ilfracombe ..	23° 35′ 144° 32′ 10″	?	1,773	Methane	No log
Mount Forbes No. 7, Mutdapilly	27° 44′ 152° 33′	300	170	Methane, inert gas..	Walloon

TABLE I—*continued*

OIL AND GAS SHOWS, OTHER THAN IN HOLES DRILLED FOR OIL AND GAS, CONFIRMED BY ANALYSIS

(Analyses are listed in Tables III and IV)

Name and Locality	Position— Latitude S. Longitude E.	Surface Elevation	Total Depth	Oil or Gas	Stratigraphy
		Ft.	Ft.		
Mount Moffat, Carnarvon Range	25° 04′ 148° 04′	?	1,773	Methane	No log
Muckadilla	26° 36′ 148° 23′	1,171	3,762	Inert gas	0–420′ Roma 420–1,010′ Blythesdale 1,010–2,500′ Walloon 2,500–3,220′ Bundamba? 3,220–3,758′ No details 3,758′ Metamorphics
Normanton	17° 40′ 15″ 141° 04′ 44″	22	2,330	Methane	0–159′ Recent or Tertiary 159–1,986′ Cretaceous 1,986–2,259′ Blythesdale? 2,259′ Granite
Norwood, Wandoan ..	26° 12′ 149° 58′	1,100	867	Methane	Walloon
Oakley No. 1, Longreach ..	23° 14′ 144° 23′	638	1,900	Methane	Cretaceous
Portland No. 3, Isisford ..	24° 06′ 144° 34′	770	4,163	Methane, oil reported	0–2,192′ Winton 2,192–3,379′ Roma 3,379–3,450′ Blythesdale 3,450–3,555′ Walloon? 3,555–3,880′ Bundamba 3,880–3,980′ Moolayember 3,980–4,163′ Permian
Red Range Spring, Taroom	25° 46′ 150° 20′	?	Surface	Inert gas, carbon dioxide	Bundamba
Ruthven No. 1, Isisford ..	24° 07′ 30″ 144° 04′	800	4,105	2·8% ethane, 32% carbon dioxide, 32% methane, 4,100′ wax, 90% petrolene	0–110′ Tertiary 110–3,118′ Cretaceous 3,118–3,450′ Blythesdale 3,450–4,009′ Walloon 4,009–4,105′ Bundamba N.B. 4,024′ may be top Permian
Ruthven No. 2	24° 14′ 35″ 144° 01′	700	4,515	4·5% ethane, 46% methane, 30% carbon dioxide. Wax reported 4,049′	0–34′ Tertiary 34–3,257′ Cretaceous 3,257–3,369′ Blythesdale 3,369–3,540′ Walloon? 3,540–3,679′ Bundamba? N.B. Chocolate and red shale below 3,679′ indicates Permian
Scarness, Pialba	25° 17′ 152° 51′	20	1,168	Methane	Cretaceous. Burrum
Scouller's, Goombi	26° 45′ 150° 25′	1,050	930	Methane	Walloon
Springleigh No. 3, Isisford ..	24° 34′ 35″ 144° 44′ 40″	968	7009	2,500′ wax, 5,450–6,700′ asphalt	0–2,000′ Winton 2,000–3,900′ Roma 3,900–3,990′ Blythesdale 3,990–4,390′ Walloon 4,390–4,603′ Bundamba? 4,603–5,372′ Moolayember 5,372–5,412′ Sill or Basalt 5,412–6,773′ Permian? 6,773–7,009′ Lower Palaeozoic
Takura, Burrum	25° 19′ 152° 35′	50	270	Methane	Tiaro
Talbalba, Cunnamulla ..	28° 54′ 146° 48′	500	1,400	Oil at 616′	0–130′ Tertiary 130–1,300′ Roma? 1,300–1,400′ Blythesdale?

TABLE I—*continued*

OIL AND GAS SHOWS, OTHER THAN IN HOLES DRILLED FOR OIL AND GAS, CONFIRMED BY ANALYSIS

(Analyses are listed in Tables III and IV)

Name and Locality	Position—Latitude S. Longitude E.	Surface Elevation	Total Depth	Oil or Gas	Stratigraphy
		Ft.	Ft.		
Tallyabra, Eromanga ..	26° 30′ 143° 30′	?	2,580	Methane, oil ..	All Cretaceous?
Tambo Town	24° 53′ 34″ 146° 15′ 05″	1317	2,450	Inert gas	0–858′ Cretaceous 858–1,002′ Blythesdale 1,002–1,460′ Walloon? 1,460–2,425′ Bundamba? 2,425–2,450′ Rewan?
Terrachie, Eromanga ..	26° 04′ 143° 49′	?	1,802	Inert gas	All Cretaceous?
Toompine, Quilpie	27° 13′ 144° 22′	..	1,150	Inert gas, carbon dioxide	0–1,108′ Shales 1,108–1,138′ Sandstone 1,138–1,150′ Shales
Wandoan Town	26° 08′ 149° 58′	880	2,150	Methane	0–1,650′ Walloon 1,650–2,070′ Bundamba 2,070–2,150′ Moolayember
Warbreccan No. 1, Stonehenge	24° 25′ 40″ 142° 46′ 40″	762	4,330	5·2% ethane, 54% methane, 14% carbon dioxide, oil reported	0–3,290′ Cretaceous 3,290–3,572′ Blythesdale 3,572–4,330′ Permian?
Wellshot No. 6, Longreach ..	23° 57′ 20″ 144° 16′ 20″	888	4,008	3% ethane, 13% carbon dioxide, 53% methane	0–2,480′ Cretaceous 2,480–2,900′ Blythesdale 2,900–3,140′ Walloon 3,140–3,260′ Bundamba 3,260–3,380′ Moolayember 3,380–4,008′ Permian?
Westland No. 1, Longreach	23° 58′ 30″ 143° 47′	678	2,890	Methane	0–2,260′ Cretaceous 2,260–2,890′ Blythesdale
Westland No. 3, Longreach	23° 54′ 143° 46′	643	2,080	Methane, 2,035′ oil..	0–2,000′ Cretaceous 2,000–2,080′ Blythesdale?
Windorah Town	25° 25′ 25″ 142° 39′ 27″	?	2,001	Methane, wax? ..	Cretaceous
Wrotham Park Spring ..	16° 26′ 143° 54′	450	Surface	Inert gas, methane, carbon dioxide	Marine Cretaceous
Wycanna Trust, Talwood ..	28° 14′ 149° 27′	780 (approx.)	4,105	Gas and oil with water flow at 2,460′	0–1,471′ Tertiary and Winton 1,471–2,445′ Roma 2,445–3,071′ Blythesdale 3,071–3,235′ Walloon 3,235–3,407′ Bundamba 3,407–4,105′ Moolayember and/or Permian At 3,750′ quartzite was present in a sample and this was taken to mean that basement had been reached. However, further drilling found water at 4,105′ so it appears that the bore did not penetrate the base of the sedimentary succession
Wyora, Winton	21° 56′ 143° 05′	850?	550	Inert gas	Cretaceous

TABLE II

REPORTED OIL AND GAS SHOWS, OTHER THAN IN HOLES DRILLED FOR OIL AND GAS, NOT CONFIRMED BY ANALYSIS, BUT CONSIDERED TO BE SIGNIFICANT

Name and Locality	Position— Latitude S. Longitude E.	Surface Elevation	Total Depth	Oil or Gas	Stratigraphy
		Ft.	Ft.		
Adrea Downs, Birdsville ..	25° 53′ 139° 22′	?	?	3,070′ show of oil ..	Cretaceous?
Arcadia Scout	25° 17′ 148° 45′	1,300	442	192′ gas and oil ..	Shown in basal Rewan
Arrolla Downs, Cloncurry ..	20° 50′ 141° 00′	540	450	Gas in several bores	Cretaceous and thin Blythesdale on shallow basement
Beaconsfield No. 5, Longreach	23° 17′ 144° 35′	733	2,483	Large volume inflammable gas	No details 0–1,100′ Cretaceous?
Blackwater—					
(1) Coal bore	23° 35′ 148° 58′	600	732	Brownish - yellow greasy substance like vaseline, at 500–600′ in (1) and 200′ in (2)	Upper Bowen
(2) Shaft	23° 31′ 148° 52′	600	200		
Boatman No. 10, Wyandra	27° 02′ 146° 41′	1,030?	2,139	Black oily liquid, inflammable	0–517′ Roma 517–703′ Blythesdale 703–1,535′ Walloon 1,535–2,105′ Bundamba 2,105′ Granite
Bonus Downs Bores, Mitchell	26° 45′ 147° 45′	1,200	3,000–3,400	Gas reported from Blythesdale	Few details; bedrock 2,000′ below sea level
Boothulla, Charleville ..	26° 22′ 145° 13′	954	3,201	Gas, large volume ..	0–2,630′ Tertiary and Cretaceous 2,630–3,200′ Blythesdale 3,200′ Bedrock
Bulgroo No. 1, Quilpie ..	25° 40′ 143° 42′	600?	5,517	3,270′ inflammable gas, 800 p.s.i. pressure, wax at bottom	0–4,621′ Cretaceous 4,621–5,372′ Blythesdale and Bundamba 5,372–5,517′ Shale
Coinda, Roma	26° 44′ 148° 37′	1,075?	2,186	Gas at 2,186′ inflammable	No details. Cretaceous and Blythesdale?
Darr River Downs No. 4, Longreach	22° 51′ 143° 52′	835	4,006	Gas	0–2,092′ Cretaceous 2,092–2,600′ Blythesdale 2,600–3,235′ Walloon 3,235–4,000′ Bundamba, etc. 4,000–4,006′ Quartzite
Delta North No. 2, Barcaldine	23° 37′ 30″ 145° 31′ 20″	970	1,610	405′ gas with water, 550–700′ green shale with 16′ greasy combustible substance	0–700′ Marine (?) Cretaceous 700–1,610′ Blythesdale and Walloon
Glenariffe, Tangorin ..	21° 40′ 144° 45′	1,005	4,220	Inflammable gas, large volume	0–150′ Tertiary? 150–1,100′ Cretaceous 1,100–1,650′ Blythesdale 1,650–2,100′ Walloon? 2,100–3,000′ Bundamba 3,000–4,220′ Permian
Hillside, Wandoan	26° 15′ 149° 24′	?	673 and 755	Inflammable gas ..	Walloon
Homeboin, Bollon	27° 23′ 147° 39′	1,034	2,558	Gas at 1,730′ ..	No details. 1,730′ top Blythesdale?
Kingsborough	22° 44′ 145° 08′	800?	1,230	Oil show when drilling	0–818′ Cretaceous 818–1,250′ Blythesdale, etc.
Lake Buchanan area ..	21° 30′ 145° 55′	1,000 (approx.)	800	Oil reported in several bores	Lower Mesozoic or Upper Bowen

TABLE II—*continued*

REPORTED OIL AND GAS SHOWS, OTHER THAN IN HOLES DRILLED FOR OIL AND GAS, NOT CONFIRMED BY ANALYSIS, BUT CONSIDERED TO BE SIGNIFICANT

Name and Locality	Position—Latitude S. Longitude E.	Surface Elevation	Total Depth	Oil or Gas	Stratigraphy
		Ft.	Ft.		
Lucknow No. 10, Boulia ..	22° 44′ 140° 56′	609	1,165	Gas and oil	Cretaceous and Blythesdale; 1,165′ granite
Mellew, Blackall	24° 02′ 145° 13′	950	3,174	2,817–2,934′ oil and gas in "puggy" shale, cased off before sampled	0–1,950′ Cretaceous 1,950–2,310′ Blythesdale 2,310–2,934′ Walloon 2,934–3,174′ Bundamba
Moonjaree No. 1, Cunnamulla	27° 53′ 145° 22′	895	2,020	Gas above 1,370′ ..	Tertiary, Cretaceous and Blythesdale. Basement 1,370′
Mount Bassett No. 2, Roma	26° 30′ 148° 53′	1,236	2,064	750′ gas and oil ..	0–260′ Roma 260–800′ Blythesdale 800–2,064′ Walloon
Portland No. 2, Longreach	23° 56′ 144° 45′	800	3,607	2,025′ gas	0–2,704′ Cretaceous 2,704–2,996′ Blythesdale 2,996–3,153′ Walloon 3,153–3,607′ Bundamba
Quilpie	26° 38′ 144° 15′	649	2,952	Gas at 1,801′ and 1,475′	2,815′ Tertiary and Cretaceous 2,815–2,952′ Blythesdale
Ravensbourne No. 4, Tambo	25° 00′ 30″ 145° 57′	1,311	4,075	Non-inflammable gas in flow, oil on water	0–2,900′ Cretaceous 2,900–3,900′ Blythesdale, Walloon, Bundamba 3,900–4,075′ No details
Stainburn No. 3, Aramac ..	22° 47′ 145° 01′	770?	1,804	Oily substance at 545′ and 1,500′	0–1,219′ Cretaceous 1,219–1,225′ Blythesdale 1,225–1,628′ Walloon? 1,628–1,804′ Bundamba
Tara	23° 34′ 144° 48′	915	2,213?	Inflammable gas ..	No log
Thurrulgoona Bores, west of Dirranbandi	28° 40′ 146° 20′	440–450	1,800 (approx.)	Gas with water flows	Details missing. Cretaceous and Blythesdale. Basement not reached
Toorak No. 4, Julia Creek ..	21° 03′ 141° 48′	492	1,497	Gas	0–1,280′ Cretaceous 1,280–1,497′ Blythesdale
Ulcanbah, Bowie	21° 58′ 145° 59′	1,000 (approx.)	800	Oil	No log
Vanrook, north-east of Normanton	16° 56′ 141° 56′	200?	1,612	Oil and gas	0–630′ Tertiary 630–1,607′ Cretaceous 1,607–1,612′ Granite? ; possibly Blythesdale
Warenda No. 19, Boulia ..	23° 05′ 140° 39′	568	780	Gas	0–700′ Cretaceous 700–780′ Blythesdale
Westland, Thompson Watershed, Longreach	23° 58′ 144° 06′	747	3,319	Gas and wax with flow water	0–2,500′ Cretaceous 2,500–2,710′ Blythesdale 2,710–3,100′ Walloon? 3,100–3,319′ Bundamba
Westland No. 2, Longreach	24° 02′ 143° 57′	802	3,480	Inflammable gas 400 cu. ft. /hr. (est.)	0–3,300′ Cretaceous 3,300–3,480′ Blythesdale
Wetherby No. 2, north of Winton	21° 31′ 142° 52′	718	3,152	Gas	No details
Whyenbah Trust, Dirranbandi	28° 09′ 148° 03′	607	3,132	Gas at pressure ..	0–591′ Tertiary 591–2,150′ Cretaceous 2,150′ Blythesdale

TABLE III
GAS ANALYSES

Bore	Depth	Date	Air	Carbon Dioxide	Methane	Ethane, etc.	Inert Gas
	ft.		per cent.	per cent.	per cent.	per cent.	per cent.
A.A.O. No. 2 (Roma)	3,550–3,552	4–3–52	17·9	0·6	1·5	..	80·0
A.A.O. No. 3 (Roma)	3,469	9–12–53	3·6	5·6	51·1	2·0	37·7
A.A.O. No. 4 (Hospital Hill)	3,694–3,714	8–6–54	1	0·5	83·1	15·4	..
	3,691–3,755	20–7–54	1	0·3	86·0	12·7	..
	3,691–3,755	21–7–54	4·5	0·8	82·3	12·4	..
	3,691–3,755	21–7–54	39·6	0·5	49·4	10·5	..
		11–5–55	0·1	0·4	84·4	12·4	2·7
A.A.O. No. 5 (Hospital Hill)	3,726–3,737	9–12–54	15·6	0·9	0·2	..	83·3
	3,700–3,740	9–3–55	..	3·2	94·0	..	2·8
Amby Downs	..	12–2–28	..	0·6	..	..	99·4
				0·7	..	..	99·3
Ardrossan No. 2	144	12–11–45	20·0	1·0	62·0	..	17·0
		12–11–45	..	1·0	81·0	..	18·0
Ashra Downs, Muttaburra	..			1·2	27·2	..	71·4
A.O.E. No. 1 (Reid's Dome)	450– 461	14–9–54	1·4	1·2	97·4	..	..
	2,699–2,716	6–10–54	..	5·6	80·7	11·8	1·9
	4,460–4,477	7–11–54	0·1	0·7	83·6	15·6	..
A.R.O. No. 1 (Hunterton)	..	24–10–28	..	5·4	60·0	..	34·6
A.R.O. No. 4 (Blythdale)	3,850	5–11–29	..	..	93·0	..	7·0
	3,840–3,844	20–3–30	..	8·5	88·0	3·0	0·5
A.R.O. No. 5 (Blythdale)	..	28–11–33	..	6·8	79·6	..	13·6
		29–12–33	4	5·6	76·8	..	13·6
		23–6–38	4·5	9·5	78·6	..	7·4
		23–6–38	4·5	10·2	79·5	..	5·8
A.R.O. No. 12 (Euthulla)	..	28–8–29	..	2·0	77·4	..	20·6
	1,988		4·0	..	64·0	..	30·6
A.R.O. No. 14 (Blythdale)	..	11–9–32	..	1·3	69·6	8·2	20·9
A.R.O. No. 15 (Bungil)	..	28–8–29	..	3·3	77·3	..	19·4
	2,063	2–9–29	..	3·3	77·3	..	19·4
A.R.O. No. 19 (Wallumbilla)	..	27–2–34	31·0	..	41·0	7·5	20·5
		27–2–34	..	..	59·0	20·0	21·0
		27–2–34	36·0	..	36·1	9·6	18·3
		27–2–34	16·0	..	61·9	9·3	12·8
		20–4–34	..	..	81·0	..	19·0
		20–4–34	..	..	66·0	17·0	17·0
Atkins' Bore, Injune Road	..	1–9–36	..	..	91·2	..	8·8
		1–9–36	..	..	88·3	..	11·7
Avington	..	30–5–28	..	3·6	..	..	96·4
Barcaldine, Municipal Bore No. 1	..	23–10–24	4·3	1·5	..	..	94·2
Beaudesert Boring Co. No. 1	1,420	15–9–30	..	0·8	64·5	..	34·7
Bender's	400	30–5–44	..	1·0	85·0	..	14·0
			Oxygen				
Beutel's No. 3	150	0–8–16	6·0	4·0	47·0	..	43·0
Bimerah No. 1	..	6–7–25	..	37·3	44·5	..	18·2
Bimerah No. 2	..	30–5–28	..	35·3	39·0	4·5	21·2
			Hydrogen				
Bishop's, Toorbul	560– 564	10–6–40	62·6	3·0	8·0	..	20·4
			Air 6·0				
		(Action of saline water on tools)					
Blackall No. 2, Town Bore	..	27–8–28	..	0·8	..	..	99·2
Borah Trust	3,500–4,005	12–7–27	..	1·1	38·5	..	60·4
Brown's, Chinchilla	..	31–1–28	..	4·9	80·5	..	14·6
		12–12–28	52·0	2·7	32·3	..	13·1
		12–12–28	32·4	0·7	62·6	..	4·3
		17–12–28	..	5·6	67·2	..	27·2
		17–12–28	..	1·0	92·6	..	6·4
		27–12–28	56·0	2·2	28·0	..	13·8
Brown's, Barcaldine	400?	23–10–24	..	1·8	..	..	98·2
Bulgroo, Quilpie (Daly's Bore)	1,300	22–1–59	Hydrogen 51·9	1·2	31·3	..	15·4
			Carbon monoxide 0·2				
Bullock's, Chinchilla	..	30–5–44	..	0·8	83·4	..	15·8
Bungil Creek, Roma	..	24–8–36	..	..	91·8	..	8·2
		24–8–36	Air	..	88·7	..	11·3
Captains Mountain, Millmerran	..	27–8–28	27·6	0·4	72·0	..	..
		27–8–28	16·7	1·2	82·1	..	..
Charleville Railway Bore	..	8–11–24	..	0·25	..	..	99·75
Charleville New Bore	..	18–11–24	43·3	0·7	..	..	56·0
Cooper's No. 1, Lowood	800	11–8–22	3·5	1·1	55·3	..	40·1
	800	11–8–22	1·75	0·35	59·1	..	38·8
	900	19–8–35	..	..	53·0	..	47·0

TABLE III—*continued*

GAS ANALYSES—*continued*

Bore	Depth	Date	Air	Carbon Dioxide	Methane	Ethane, etc.	Inert Gas
	ft.		per cent.	per cent.	per cent.	per cent.	per cent.
Cowley Downs	2,146	23–11–24	33·3	2·3	3·9	..	36·5
			Hydrogen 24·0				
Cockatoo Spring	Surface	12–3–24	..	5·6	79·4	..	15·0
Clifford No. 3, Yuleba	145	4–10–46	..	1·0	90·0	..	9·0
			Oxygen				
Cribb Island, Jackson's Estate	30–70	4–8–20	2·8	2·8	60·0	..	34·4
			Air				
Crowman No. 22	..	14–1–28	1·3	0·5	92·0	..	6·2
		15–1–28	..	0·6	94·4	..	5·0
Daniel's No. 4	370	21–9–26	26·0	1·4	4·8	..	24·0
						Hydrogen	
Daniel's No. 4, Emerald	412	4–9–26	..	1·4	48·2	25·8	24·6
	415	4–9–26	..	1·0	45·5	7·0	46·5
		21–9–26	22·0	1·0	73·7	..	3·3
		21–9–26	48·0	0·9	49·1	Ethane &c.	2·0
Dan's, Kalgun	..	31–10–27	36·7	5·3	..	..	58·0
Elderslie No. 1	..	8–6–28	..	7·2	22·8	3·5	66·5
Enniskillen No. 2	2,000	31–10–24	..	4·3	2·3	..	93·4
Eromanga No. 1	..	9–2–25	0·9	0·4	32·9	..	65·8
		9–7–25	..	trace	90·3	..	9·7
Eromanga No. 2	..	9–7–25	trace	56·4	31·2	..	12·4
Eulolo, McKinlay	..	24–10–28	..	..	..	..	100·0
Evesham No. 1, Longreach	4,100	17–9–28	..	4·2	74·0	4·1	17·7
Gardner's, Helidon	..	20–10–30	..	31·1	56·3	..	12·6
		20–10–30	..	40·2	44·5	..	15·3
		20–10–30	..	34·9	50·0	..	15·1
Gartmore	1,685	1–11–24	..	3·7	..	..	96·3
Glenalvon	..	1926	2·5	0·5	57·0	..	40·0
		1926	9·5	0·5	55·0	..	35·0
		1926	12·0	1·0	69·3	..	17·7
		1926	10·0	0·5	67·5	..	22·0
Hascombe, Isis Downs No. 2	..	30–5–28	..	4·1	40·7	..	55·2
Helidon Spa Bore	..	20–10–30	..	82·0	5·7	..	12·3
		20–10–30	..	86·5	10·3	..	3·2
Hopeland Trust	4,255	28–2–28	..	1·5	..	..	98·5
..		28–2–28	..	3·6	..	..	96·4
Ilfracombe	2,450	28–10–24	..	2·8	66·8	..	30·4
Innot Hot Spring, Nettles Creek	Surface	24–11–38	..	1·8	..	..	98·2
Isis Petroleum Syndicate (Elliott River) ..	590– 600	27–6–23	9·5	0·8	41·4	..	48·3
		27–6–23	7·8	trace	37·7	..	54·5
Julia Creek	..	1–10–28	..	1·6	..	..	98·4
Railway Bore	..	..	3·5	2·8	..	..	93·7
Scout Bore	..	9–10–28	..	2·2	..	..	97·8
Katnock, Oxton Downs	..	9–10–28	4·0	2·1	..	..	93·9
Kayenta No. 4 (Gunnewin)	..	17–9–28	59·5	1·5	39·0	..	..
Kaywanna Trust	3,345	14–6–27	..	0·6	76·4	..	23·0
						Hydrogen	
Lander Oilfields (Australia) Ltd. No. 1		8–12–25	5·0	trace	2·3	80·0	12·7
(Orallo)		8–12–25	13·3	1·0	3·7	65·6	16·4
	2,180	15–1–26	12·4	..	..	..	87·6
L.O.A.L. No. 3 (Orallo)	2,150	26–7–26	5·0	3·7	..	..	91·3
	2,220	26–7–26	55·0	0·4	..	..	44·6
						Ethane &c.	
L.O.A.L. No. 4 (Hospital Hill)	..	3–11–29	..	1·0	48·4	29·2	21·4
Longreach Town No. 2	3,298	16–2–25	..	1·8	65·6	..	32·6
	2,500	16–2–25	29·6	1·5	44·0	..	24·9
Longreach Town Bore	..	6–2–25	..	3·6	60·9	..	35·5
L.O.W. No. 1 (Longreach)	2,486	4–10–29	4·0	1·4	64·0	Hydrogen	30·6
	2,910	28–10–29	...	7·2	50·5	27·5	14·8
	2,336	..	..	..	66·2	..	33·8
	3,229	..	..	9·1	72·0	..	18·9
Lowood No. 2	320	..	52·6	1·7	33·2	..	12·5
Lynfield No. 2	..	..	22·0	1·2	71·2	..	5·6
Mcfarlane Downs	3,095	31–10–24	2·4	5·7	..	..	91·9
Manfred	..	19–11–28	..	21·0	..	..	79·0
Maria Creek	..	14–4–43	76·0	23·0	1·0	..	..
Marie Vale	..	20–3–25	24·5	2·2	55·7	..	17·6
Mount Forbes No. 7, Mutdapilly	117–170	25–8–26	2·5	0·5	57·0	..	40·0
		25–8–26	9·5	0·5	55·0	..	35·0
		26–8–26	12·0	1·0	69·3	..	17·7
		26–8–26	10·0	0·5	67·3	..	22·0
Muckadilla	..	24–6–24	trace	trace	14·7	..	85·3

TABLE III—*continued*

GAS ANALYSES—*continued*

Bore	Depth	Date	Air	Carbon Dioxide	Methane	Ethane, etc.	Inert Gas
	ft.		per cent.	per cent.	per cent.	per cent. Ethane	per cent.
Murilla Oil Co. No. 1 (Boyanda)	2,130	6–8–37	56·1	1·0	31·5	11·4	..
	2,510	3–10–38	..	2·9	26·1	35·4	35·6
	2,510	11–12–38	..	1·5	84·7	12·7	1·1
	2,510	11–12–38	..	1·4	93·2	5·1	0·3
	2,510	11–12–38	1·0	..	98·7	0·3	..
		6–2–40	..	0·7	80·0	..	19·3
Nathan Gorge, Dawson River	..	31–8–22	20·6	1·2	49·3	..	28·9
Normanton	2,014	8–10–34	..	3·0	63·5	..	33·5
Norwood	867	30–7–52	..	..	99·0	..	1·0
Oakley No. 1	..	19–2–25	18·5	1·6	54·2	..	25·7
Oil Search Ltd. No. 1 (Warooby)	3,600–3,794	3–9–34	..	..	82·0	6·5	11·5
		3–9–34	..	..	78·0	6·8	15·2
		3–9–34	..	1·6	78·2	5·8	14·4
		3–9–34	..	1·5	81·0	6·3	11·2
		10–9–34	16·0	..	53·0	3·0	28·0
	3,600–3,756	3–7–35	..	0·7	81·0	5·5	12·8
		24–3–52	2·6	..	93·0	3·2	1·2
		24–3–52	1·6	..	91·7	4·9	1·8
Oil Search Ltd. No. 2 (Hutton Creek) ..	..	8–5–36	..	3·0	89·0	..	8·0
Oil Search Ltd. No. 3 (Arcadia)	1,187–1,189	22–10–36	..	3·0	87·5	5·2	4·3
	1,695	23–11–36	..	2·8	80·2	5·6	11·4
	1,880	23–11–36	..	2·7	84·0	5·3	8·0
	2,030	26–11–36	40	2·8	45·4	3·7	8·1
	2,028	10–12–36	..	4·7	76·8	8·0	10·5
		10–12–36	..	5·1	79·8	6·0	9·1
		10–12–36	..	73·6	19·3	3·5	3·6
		10–12–36	..	72·6	19·3	3·5	4·6
	2,566	10–12–36	..	72·9	19·2	3·5	4·4
	2,566	10–12–36	..	71·0	20·8	3·9	4·3
	2,618	15–12–36	..	73·6	20·7	3·8	1·9
		19–5–37	10	61·5	20·0	3·3	5·2
	2,559	29–5–17	..	66·5	26·0	4·0	3·5
		0–6–37	..	77·0	9·2	3·5	10·3
		0–6–37	..	81·0	11·7	2·1	5·2
		0–6–37	..	80·0	12·4	2·2	5·4
	3,697	0–6–37	..	80·0	12·3	2·3	5·4
	2,670–2,697 and 2,559	9–6–37	..	77·0	13·2	2·0	7·8
	2,670–2,697	6–7–37	..	77·0	17·4	1·4	4·2
	3,055	25–10–37	..	80·2	12·9	2·2	4·7
	3,170	25–10–37	8	72·0	11·0	1·7	7·1
	3,830	15–11–37	..	77·5	15·6	3·4	3·5
		10–12–37	..	74·3	19·2	3·1	3·4
		10–12–37	..	64·6	25·6	4·5	5·3
		16–12–37	..	81·6	12·2	3·2	3·0
		17–3–38	..	74·0	21·3	2·6	2·1
		5–7–38	..	73·4	20·0	3·7	2·9
	Above 2,887	14–12–39	..	69·5	20·2	2·0	8·3
		12–12–39	35	5·0	37·4	..	22·6
		26–9–39	5	56·2	32·6	2·0	4·2
		14–6–38	..	75·0	18·0	4·2	2·8
Pearson's, Numbilla	400	3–8–28	66·7	2·3	24·6	..	6·4
Peter's, Helidon	..	20–10–30	..	28·4	56·0	..	15·6
	..	..	..	..	87·0	..	13·0
Petrie's Bore, Injune Road	..	24–8–36	..	..	91·8	..	8·2
		24–8–36	..	..	88·7	..	11·3
		1–9–36	..	..	86·0	..	14·0
Portland	..	30–5–28	..	7·8	74·4	..	17·8
Portland No. 3	..	30–8–28	..	8·2	75·0	..	16·8
Queensland Oil Development Co. Ltd. No. 1 (Langdale)	1,928	1927	..	1·3	75·7	7·7	15·3
			Carbon				
Q.G. No. 2 (Hospital Hill)	..	24–11–26	monoxide	..	62·3	..	37·7
	3,683–3,710	1901	5·8	1·5	72·6	16·3	3·4
Q.G. No. 3 (Hospital Hill)	3,702	1920	..	..	34·0	..	66·0
		1920	..	0·96	63·2	27·0	8·8
			Oxygen				
Q.G. No. 4 (Hospital Hill)	1,889–1,950	1916	0·6	1·0	93·0	..	5·4
	1,889	..	..	1·5	95·0	..	3·5
	3,770	11–12–21	..	..	87·2	8·99	3·49
		Helium 1	in 12,000	(0·008%)			
		25–11–26	Air	..	15·2	..	84·8
		1–8–26	2·0	0·8	72·0	..	25·2

TABLE III—*continued*

GAS ANALYSES—*continued*

Bore	Depth	Date	Air	Carbon Dioxide	Methane	Ethane, etc.	Inert Gas
	ft.		per cent.	per cent.	per cent.	per cent.	per cent.
R.B.O. No. 1 (Mount Bassett)	2,550	3–11–29	..	0·4	84·9	..	14·7
	2,440–2,447	9–11–30	..	3·2	..	..	96·8
	2,440–2,447	9–11–30	..	1·6	..	..	98·4
		15–7–37	65·0	1·0	27·0	..	7·0
R.B.O. No. 2 (Mount Bassett)	..	3–5–39	79·0	1·0	20·0	..	..
R.B.O. No. 3 (Mount Bassett)	Below 3,547	7–5–40	..	1·0	83·0	2·3	13·7
		7–5–40	..	0·8–2·4	80–86	2·2–4·3	10·5–14·4
		20–5–40	..	1·2–2·0	85–89	1·0–2·5	8·1–10·3
		17–3–41	..	4·0	75·0	..	21·0
R.B.O. No. 4 (Mount Bassett)	3,459–3,514	17–3–41	..	5·0	70·0	4·0	21·0
	Below 3,459	17–3–41	30·0	1·0	..	..	69·0
		29–4–41	63·0	2·0	35·0	..	..
		29–1–53	0·3	6·3	55·2	..	38·2
			Oxygen				
Red Rangs Creek, Taroom	Surface	12–3–24	1·1	34·5	..	..	64·4
		14–5–25	Air 42·5	1·25	..	..	56·25
Roma No. 1	..	24–11–26	..	..	62·3	..	37·7
Roma No. 2	..	24–11–26	..	..	34·0	..	66·0
Roma No. 3	..	25–11–26	..	..	15·2	..	84·8
Roma No. 4	..	28–9–27	..	0·8	..	..	99·2
R.O.C. No. 1 (Hospital Hill)	..	28–9–27	..	..	..	..	100·0
		19–10–27	..	..	..	..	100·0
		0–11–27	..	Helium	..	..	..
	3,550–3,705	3–8–28	5·0	0·04	84·5	9·5	1·0
				Carbon			
R.O.C. No. 2 (Hospital Hill)	..	3–7–29	..	dioxide	75·5	17·5	7·0
		28–12–28	5·0	0·3	..	..	94·7
		28–12–28	..	0·3	..	..	99·7
	2,200	11–2–29	..	0·7	38·1	..	61·2
	2,200	11–2–29	..	2·0	15·3	..	82·7
	3,916	2–2–29	..	0·7	27·2	..	72·1
	From 8″ casing	15–3–29	..	0·4	91·0	traco	8·6
		25–3–29	..	..	72·7	15·2	12·1
		25–3–29	33·0	..	55·3	7·0	4·7
		25–3–29	..	..	78·5	15·7	5·8
		25–3–29	3·3	..	75·8	14·7	6·2
	Water level 3,600	8–4–29	..	0·7	78·8	15·2	5·3
		10–4–29	..	0·7	76·5	14·9	7·9
R.O.C. No. 3 (Hospital Hill)	3,600–3,700	30–4–30	..	..	82·8	15·7	1·5
R.O.C. Water Well	1,068–1,077	15–4–29	..	1·5	..	..	98·5
Roma Town Water No. 4	1,889–1,950	16–4–17	0·6	1·0	93·0	..	5·4
Ruthven No. 1	..	27–10–24	2·0	32·2	32·5	2·8	30·5
Ruthven No. 2	2,250	0–6–28	22·4	23·5	35·3	3·3	15·5
Scarness Boro	..	17–4–46	..	2·0	64·0	..	34·0
Scouller's	850	24–5–17	..	0·2	96·5	..	3·3
		28–2–28	39·0	0·7	59·0	..	1·3
		28–2–28	4·5	0·7	93·1	..	1·7
		28–2–28	..	0·4	97·7	..	1·9
S.O.E. Scout Bore No. 2 (Canaway Downs)	? above 1,300 (W. G. Sinclair, Analyst)	20–11–58	Oxygen 3·2 Carbon monoxide 0·4	..	63·1	Hydrogen 13·0	20·3
	1,275 (Govt. Chem. Lab., Brisbane)	16–1–59	Oxygen 0·1	0·4	88·8	..	10·7
S.O.E. Scout Bore No. 3 (Gumbla)	560 (W. G. Sinclair, Analyst)	12–6–59	Oxygen 1·1	1·2	11·0	Hydrogen 58·2	28·5
	700 (W. G. Sinclair, Analyst)	12–6–59	Oxygen 7·3 Carbon monoxide 0·4	0·9	9·1	Hydrogen 38·9	43·4
	700 (Govt. Chem. Lab., Brisbane)	3–6–59	Oxygen 6·6	0·4	2·4	Hydrogen 52·5	38·1

TABLE III—*continued*

GAS ANALYSES—*continued*

Bore	Depth	Date	Air	Carbon Dioxide	Methane	Ethane, etc.	Inert Gas
	ft.		per cent.	per cent.	per cent.	per cent.	per cent.
S.O.E, Scout Bore No, 3 (Gumbla)—*continued*							
	803 (Govt. Chem. Lab., Brisbane)	3–6–59	Oxygen 1·8	0·9	2·2	Hydrogen 75·2	19·9
	945 (Govt. Chem. Lab., Brisbane)	18–6–59	Oxygen 9·8	0·5	9·8	Hydrogen 27·0	52·9
	945 (W. G. Sinclair, Analyst)	10–7–59	Oxygen 0·06	1·6	73·4	Hydrogen 6·2	18·2
	1,146 (Govt. Chem. Lab., Brisbane)	1–7–59	Oxygen 4·7	1·2	32·7	Hydrogen 25·1	36·3
	1,155 (Govt. Chem. Lab., Brisbane)	10–7–59	Oxygen 8·9	0·3	37·4	Hydrogen 1·7	51·7
	1,164 (W. G. Sinclair, Analyst)	10–7–59	Oxygen 3·6	2·4	24·6	Hydrogen 26·2	43·2
	1,405 (Govt. Chem. Lab., Brisbane)	25–8–59	Oxygen 0·3	..	56·2	Hydrogen 33·0	10·5
	? above 1,500 (Govt. Chem. Lab., Brisbane)	28–8–59	Oxygen 15·1	0·5	16·5	Hydrogen 6·2	61·7
Springbok No. 4	..	15–1–28	Air 78·0	..	16·8	..	5·2
Stewart's Mooga No. 1	1,284	28–12–28	..	1·4	93·0	..	5·6
Takura (Burrum)	270	9–3–15	..	..	98·0	..	2·0
Tallyabra No. 1	2,583	9–2–25	..	0·5	81·4	..	18·1
		9–2–25	..	0·7	81·4	..	17·9
Tambo, Town Bore	..	2–11–24	10·5	3·7	..	..	85·8
Terrachie, 6 mile Bore	1,200	1922	54·0	5·1	tr.	..	40·9
Toompine, Quilpie	..	13–7–25	..	37·5	..	..	62·5
Tysons, Helidon	..	20–10–30	5·0	65·4	23·0	..	6·6
Vowles, Dalby	..	24–11–15	19·0	5·0	68·0	..	8·0
Wandoan Town	800	3–12–45	..	1·0	84·0	Ethane &c.	15·0
Warbreccan (flowing bore, R.N. 4,783) ..	..	7–10–28	5·0	14·0	54·0	5·2	21·8
		7–10–28	..	11·6	53·0	6·1	29·3
		1928	..	..	68·5	..	31·5
		12–10–54	Oxygen 8·3	14·6	31·2	3·5	42·4
Wellington Point Oil Wells No. 1 (Birkdale)	1,565	10–11–31	..	..	50·0	Hydrogen 34·0	16·0
	1,650	24–11–31	Air 4·0	4·0	50·7	Hydrogen 28·0	13·3
Wellshot No. 6, Cleanskin Bore	800	1–11–28	..	13·1	52·6	Ethane &c. 3·0	31·3
			3·5	1·1	55·3	..	40·1
			1·75	0·35	59·1	..	38·8
Westland Water Bore No. 1	..	13–4–27	6·5	7·8	77·5	..	8·2
Westland Water Bore No. 3	..	13–4–27	..	2·1	89·1	..	8·8
		13–4–27	..	2·2	87·4	..	10·4
Windorah No. 1	..	6–7–27	46·2	2·8	43·3	..	7·7
Winneills Pty. Ltd. No. 1 (Brigalow) ..	220–223	7–12–54	0·3	0·5	96·0	..	3·2
W.P.L. Bores (Mount Walker)	180	27–1–54	..	0·5	97·5	..	2·0
Wrotham Park, Lee's Springs	..	14–12–29	..	10·5	30·7	..	58·8
Wycanna Trust, Talwood	..	14–11–56	Oxygen 0·9	0·5	20·2	..	78·4
		14–11–56	..	0·8	21·4	..	77·8
Wyora Bore	..	19–11–28	..	1·2	10·3	..	88·3
Yaraka	..	18–3–30	..	..	96·0	..	4·0

TABLE IV

OIL ANALYSES

Bore	Depth	Date	Remarks
	ft.		
A.R.O. No. 4 (Blythdale) ..		7–2–30	Crude wax .. 40·0% Petrolene .. .. 81% Organic matter .. 4·0% Asphaltine .. .. 19% Water .. .. 17·0% Mineral matter .. 39·0%
	3,844–3,847	20–3–30	A 1·2 oz. sample contained 21 grains of dark coloured heavy mineral oil which poured readily at 25°C.
A.R.O. No. 5 (Blythdale) ..	..	25–8–30	Distillation Test Under 250°C. .. Nil 250–300° .. .. 12% 300–340° .. .. 20% (–16″ mercury) 340–370° .. .. 38% (–16″) Over 370° .. .. 23% (–16″)
A.R.O. No. 12 (Euthulla) ..	1,270	17–5–29	Water .. .. 79·7% Mineral matter .. 9·7% Oil .. .. 3·8% Other organic matter .. 6·8% The oil was a brown-black mineral oil just pouring at 20°C.
	..	25–6–29	Water .. .. 50·5% Mineral matter .. 36·9% Wax .. .. 0·2% Other organic matter .. 12·4%
A.R.O. No. 13 (Euthulla) ..	910	1–5–29	Water .. .. 79·5% Mineral matter .. 12·3% Free oil .. .. 1·4% Other organic matter .. 6·8% Sludge skimmed from 3 bailings
	975–1,000	1–5–29	Sludge in ditch— Water .. .. 85·2% Mineral matter .. 14·2% Free oil .. .. 0·04% Other organic matter .. 0·56%
	1,060	25–6–29	Water .. .. 14·2% Mineral matter .. 54·6% Mineral oil .. 15·7% Other organic matter .. 15·5% A brownish-black mineral oil just pouring at 20°C.
B.A.O.S. No. 1 (Gatton) ..	930 945	10–3–32 15–3–32	Thick dark brownish-black mineral oil 5% Water .. .. 30% Earthy matter .. 31% Oil .. .. .. 27% Coal, etc, ... 12% The oil was brownish-black with the consistency of vaseline at 25°C.
Boulia area, 12 miles north of Chatsworth Homestead	Outcrop	1957	Pomegranate Lst. (Upper Cambrian) (a) 13·2 bbls/acre–ft. residual oil Porosity 3·95%. Permeability zero (b) 13·6 bbls/acre–ft. residual oil Porosity 1.16%. Permeability zero
4 miles north-west of Chatsworth Homestead	Outcrop	1957	Chatsworth Lst. (Upper Cambrian) (a) 7·5 bbls./acre–ft. residual oil Porosity 1·06%. Permeability zero (b) 0·23 bbls/acre–ft. residual oil Porosity 0·6% Permeability zero
Digby Peaks	Outcrop	1957	Ninmaroo Lst. (Upper Cambrian–Lower Ordovician) 8·76 bbls/acre–ft. residual oil Porosity 0·94%. Permeability zero
Black Mountain	Outcrop	1957	Ninmaroo Lst. (Upper Cambrian–Lower Ordovician) (a) Near base of section (Upper Cambrian) 10·1 bbls/acre–ft. residual oil Porosity 2·2%. Permeability zero (b) 1,000 ft. above base of section (Upper Cambrian–Lower Ordovician contact) 4·8 bbls/acre–ft. residual oil Porosity 1·45%. Permeability zero (c) 1,800 ft. above base of section (Lower Ordovician) 3·1 bbls/acre–ft. residual oil Porosity 2%. Permeability zero
Bell's Topel Bore No. 1 (Boonah)	102	6–1–22	0·17% free oil
Cairnhope No. 2	..	28–8–25	Water .. .. 31% Brownish-black oil, consistency of vaseline at 20°C. Mineral oil .. 47% Mineral matter .. 17% Organic Matter .. 5%

TABLE IV—*continued*

OIL ANALYSES—*continued*

Bore	Depth	Date	Remarks
	ft.		
Cleeve Water Bore	..	9–7–25	Sludge. Weight 350 grams, free oil 0·02 grams (0·006%)
	1,600	9–7–25	Oil shale. Free oil 0·52%
	1,500	9–7–25	Oil shale. Free oil 0·06%. Free oil here is sticky and resinous at 20°C.
Condamine Oil Ltd. No. 1 (Speculation)	2,212	19–4–55	Chloroform extract 17·3%—consisted of a light coloured mineral oil which may have been lubricating oil or mineral oil grease
Cooper's No. 1 (Lowood) ..	..	1–8–22	Sludge : 0·1% thick oil. The traces of oil were associated with finely divided oil shale particles
Cribb Island Bore, Jackson's Estate	..	9–7–20	Petrolene 0·2%
Delta Oil N.L. No. 1 (Barcaldine)	634–638	10–8–29	Sludges : 0·4% and 0·2% free oil. The oil extracted was reddish-yellow and resembled an oil shale extract
Dunn's Bore, Beaudesert ..	82	1921	Five gallons of oil with composition— 95% Kerosene 5% Lubricating oil
Henrickson's, Fassifern (Bible Creek)	..	5–6–18	Sample from shaft— Oil extract .. .. 0·22% Asphalt .. .. 0·44%
Injune Bore	275–279	7–10–53	Sample of grease. Mineral oil 66%. The oil was brown in colour and had the consistency of vaseline at 28°C. It could have been a refined product A sludge contained 0·03% mineral oil

Inverleigh West				Weight Sample	Mineral Oil	Mineral Oil	Colour	Consistency
	..	20–11–30	Sludge 2,000 ft.	gm. 16	gm. 2	% 12·5	Dark-brown	Thick, just poured at 25°C.
	..	20–11–30	Residue 2,000 ft.	4·0	1·3	32·5	Dark-brown	
	..	20–11–30	Sludge 1,800 ft.	100	1·8	1·8	Red-brown	

Kaywanna Trust	..	14–6–27	Free oil 7·4% Thick mineral oil at 20°C. Free oil 4·7% Thick mineral oil at 20°C. Free oil 0·7% Thick mineral oil at 20°C.

Knockaninny				Wt. Sample	Oil	Oil	
	2,176	22–2–29	Sludge	oz. 12	gm. 0·28	% 0·08	Dark-brown mineral oil with consistency of thick lubricating oil at 25°C.
				9·0	3·1	1·2	

Lander Oilfields (Australia) Ltd. No. 1 (Orallo)	..	19–2–24	Soluble petroleum 2·4% and 3·3%. A pale reddish thick oil that would just flow at ordinary temperature
	..	22–8–25	Mud fluid contained 9·3% mineral oil. Scum from mud fluid contained 7·4% mineral oil
	..	24–8–25	Free oil was brownish-black and had the consistency of vaseline at 20°C.
L.O.A.L. No. 3 (Orallo) ..	2,050	22–6–26	Ditch sludge contained 2·9% heavy black mineral oil Drillers sludge contained 1·8% heavy black mineral oil
	2,050	14–7–26	Free oil 0·1%
	2,050	27–7–26	Free mineral oil 2·38% Free mineral oil 1·32% } The oil was dark-brown with the consistency of heavy lubricating oil at 20°C.
L.O.A.L. No. 4 (Hospital Hill)	758	13–5–29	Water .. .. 71·4% Oil .. .. .. 0·4% } thick, dark-coloured mineral oil just poured at 20°C.) Mineral matter .. 25·5% Organic matter and water .. .. 2·7%

TABLE IV—*continued*

OIL ANALYSES—*continued*

Bore	Depth	Date	Remarks
	ft.		
Longreach Town Bore	..	6–2–25	Brownish-black mineral wax consisting of petrolene 96·4% and asphaltine 3·3%. Sp. Gr. at 30°C.–0·923. Dropping point 63°C.
Longreach No. 2	..	9–3–25	Wax. Petrolene 96·22%, Asphaltine 3·4%, Sp. Gr. at 25°C.–0·927. Dropping point 59°C.
Longreach Water Bore No. 2 ..	..	12–9–29	Water .. .. 35·2% Mineral matter .. 3·0% Bitumen .. .. 59·8% Other organic matter 2·0% The bitumen was in the form of a brown-black wax with a dropping point of 49°C. and yielded petrolene 91·8%, asphaltine 8·2%
L.O.L. No. 4 (Longreach) ..	..	31–5–55	The sludge contained 8% oil which had general characteristics similar to that of the oil in the pipe dope
L.O.W. No. 1 (Longreach) ..	2,486	4–10–29	Water .. .. 36·2% Mineral matter .. 17·6% Bitumen .. .. 32·3% Other organic matter 13·9% The bitumen was in the form of a brown-black wax and yielded petrolene 98·5%, asphaltine 1·5%
	2,910	28–10–29	Water .. .. 55·9% Mineral matter .. 19·9% Free Oil .. .. 2·4% Other organic matter 21·8%
Macfarlane Downs, Trial Bore ..	..	20–2–22	Total bitumen (soluble in chloroform) 0·26% in an oil shale
Male's Bore, Tara	..	11–1–27	Sample of oil shale. Free oil 0·2%. A red-brown wax at 30°C.
Malta Oil Co. No. 1 (Nive River)	Above 550	28–8–24	Skimmings from boiled water—0·0044% free oil; skimmings from run-off drain 0·145% free oil. (Oil pale yellow and mineral grease at 20°C.)
Mount Moffatt	267	12–1–40	Wt. of sample 3·8 gms. Mineral oil content 10·5%
Mount Whitestone (Mason's Property), Grantham	..	16–11–17	Mud yielding 1·3% of extract consisting of a mixture of a paraffin-like substance and oil
		16–11–17	Heavy mineral oil or wax in mud 0·25%
Murilla Oil Co. No. 1 (Boyanda)	4,020	29–10–40	Mineral oil 60%. Has the consistency of vaseline at 82·5°F. Trace of light oil recovered by steam distillation
	3,600	0–5–41	Mineral oil 60·0%. The mineral oil was light-brown and had a consistency similar to that of vaseline. No light oil present
		30–8–48	Thick dark mud contained 0·08% mineral oil. From bailings to 4,721 ft. thick mud contained 0·08% mineral oil and the remaining fluid 0·1% mineral oil
	4,732	26–4–49	0·4% mineral oil
	4,735	...	0·12% mineral oil A light-brown oil with a consistency similar to vaseline at 28°C.
Queensland Coastal Oil Concessions (North) No. 1 (Towantin)	..	26–5–24	Free oil 2·6%; consistency of mineral grease at 20°C.
	495–497	28–5–24	Free oil 0·21%
	580	27–6–24	Free oil 1·13% and 0·34% of samples; consistency of mineral grease at 20°C.
	635	22–7–24	Free oil .. .. 0·14% } Has the consistency of mineral grease at 20°C.
	643	22–7–24	Free oil .. .. 0·66% }
	652	22–7–24	Free oil .. .. 0·54% }
	673	11–8–24	Free oil .. .. 3·3 % }
	677	..	Free oil .. .. 0·55%
	813	30–9–24	Free oil .. .. 0·12%. A pale yellow oil with the consistency slightly less viscous than that of vaseline at 20°C.
Queensland Oil Corporation No. 1 (Wolston)	..	3–8–26	Chloroform extract 0·2%
	..	5–10–27	Mineral oil .. .. 0·12% } Oil has the consistency of lubricating oil Mineral oil .. .. 0·14% }
Q.R.O. No. 1 (Gubberamunda)	910	29–1–29	Sludge. Weight of sample 26 ozs. Heavy mineral oil 6·5 gms. (0·9%). The free mineral oil was brownish-black and had the consistency of heavy lubricating oil at 30°C.
	2,445	31–5–29	Water .. .. 88·8% Mineral matter .. 5·1% Oil .. .. .. 2·3% Other organic matter 3·8%
R.B.O. No. 1 (Mount Bassett) ..		17–11–30	Oil. No petrol fraction. Sp. Gr. 0·8758
	2,445	17–11–30	Distillation Range:—First drop at 150°C., 10% at 230°, 20% at 260°, 30% at 290°, 40% at 317°, 50% at 330°C. The remaining 50% distilling over at 330°C. consisted principally of gas, oil and lubricating oil. It did not contain any petrol and yielded approximately 20% kerosene fraction and 20% "solar oil" fraction

TABLE IV—*continued*

OIL ANALYSES—*continued*

Bore	Depth	Date	Remarks
	ft.		
R.B.O. No. 1 (Mt. Bassett) —*continued*	..	17–7–37	Sample consisted of an emulsion of mineral oil and water (8%) with a small proportion of siliceous matter held in suspension. Sample from bailer tube—Sp. Gr. of distillate to 350°C. was 0·864 at 20°C.; Sp. Gr. of residual oil was 0·924 at 20°C. The sample did not contain any petrol
R.B.O. No. 3 (Mount Bassett) ..	3,554–3,557	11–3–40	Mineral oil .. .. 0·30%
	3,616	..	Mineral oil .. .. 0·35%
	..	17–4–46	Weight 145 gms.; steam distillation 3·0 cc (about 2% Vol./Wt.) light oil, kerosene type; ether and chloroform extraction 33 gms. (22·7%); Sp. Gr. 0·904 at 25°C.
R.B.O. No. 4 (Mount Bassett)	..	6–3–41	Light oil recovered by steam distillation of crushed sample was less than 0·1%. Mineral oil (chloroform extraction) 0·08%. The mineral oil was dark-brown and mobile at 84°F.
	3,497–3,508	12–3–41	Light oil recovered by steam distillation of crushed ore 0·5%, Mineral oil (chloroform extract) 0·7%
	Below 3,459	17–3–41	Sludges—

Volume Received	Light Oil Kerosene type	Mineral Oil	Total Mineral Oil
c.c.	c.c.	c.c.	c.c.
510	1·0	4·5	5·5
500	3·0	4·5	7·5
10	20·0	42·0	62·0
280	5·0	28·5	33·5

	..	29–4–41	Oil, Sp. Gr. 0·903 at 25°C.
R.O C. No. 1 (Hospital Hill) ..	..	14–7–27	Sludge: 6·7% free oil. The oil extract had the consistency of mineral grease at 20°C.
	..	24–9–27	Oil—a light "kerosene" Sp. Gr. 15·5°C.—0·789
	..	26–9–27	Oil—a light "kerosene" Sp. Gr. 15·5°C.—0·787
	..	28–9–27	Sludge: free oil 6·4%. Dark-brown oil with the consistency of cylinder oil at 20°C.
	..	21–8–27	Oil: Sp. Gr. 60°F.—0·792. Flash Pt. 77°F. (?). Colour pale amber, strong fluorescence. Light kerosene
	..	6–9–27	Oil: Sp. Gr. 60°F.—0·772. Flash Pt. less than 50°F., equal parts of benzine and kerosene
	..	16–9–27	Emulsion: Oil 76%, Water 16%, Emulsion 8%. (Oil: 93% kerosene, 7% heavy oil. Sp. Gr. 70°F.—0·800)
	..	1–10–27	Oil-kerosene fraction
	..	13–10–27	Emulsion: Water 70·0%, Emulsion 30%
	..	13–10–27	Emulsion: Water 45%, Emulsion 55%
	..	13–10–27	Emulsion: of 95% light mineral oil
	..	13–10–27	Emulsion: Oil 84%, Water 10%, Emulsion 6%. Oil Sp. Gr. 60°F.—0·776
	..	14–10–27	Oil: Pale straw, Sp. Gr. 60°F.—0·773. Kerosene fraction
	..	14–10–27	Emulsion: Water 11%, Oil 68%, Emulsion 21%. Oil: Pale straw. Sp. Gr. 60°F.—0·775
	..	14–10–27	Oil: Sp. Gr. 60°F.—0·776, pale straw
	..	14–10–27	Pale straw light oil
	..	14–10–27	Dark oil: Oil 90%, colourless white emulsion 10%
	..	14–10–27	Oil: Pale straw light oil
	..	15–10–27	Oil: Pale straw. Sp. Gr. 60°F.—0·772. Light oil (benzine and kerosene)
	..	15–10–27	Emulsion: Oil 34%, Water 40%, Emulsion 26% (20% oil)
	..	16–10–27	Oil on sump: Oil 60%, Water 10%, Emulsion 30%. Oil: Pale straw. Sp. Gr. 60°F.—0·774
	..	16–10–27	Mud fluid: Water 60%, Oil 24%, Emulsion 16% (60% oil)
	..	16–10–27	Oil: about equal benzine and kerosene fractions
	..	16–10–27	Emulsion: Oil 60%, Water 10%, Emulsion 30%
	..	17–10–27	Oil: Pale straw. Sp. Gr. 60°F.—0·774
	..	17–10–27	Oil: Pale straw. Sp. Gr. 60°F.—0·778, mainly kerosene
	..	18–10–27	Oil: Pale straw. Sp. Gr. 60°F.—0·778, mainly (about 70%) kerosene fraction
	..	18–10–27	Water and Emulsion: Water 88%, Oil 10%, Emulsion 2%
	..	19–10–27	Oil: similar to above. Sp. Gr. 60°F.—0·780
	..	19–10–27	Oil: Pale straw. Sp. Gr. 60°F.—0·778, as above
	..	19–10–27	Emulsion: Water 80%, Oil 13%, Emulsion 7% (chiefly oil)
	..	20–10–27	Oil: Water white. Sp. Gr. 60°F.—0·772, equal kerosene and benzine fractions

TABLE IV—*continued*

OIL ANALYSES—*continued*

Bore	Depth	Date	Remarks
R.O.C. No. 1 (Hospital Hill) —*continued*	ft.		
	..	20–10–27	Emulsion : Oil 33%, Emulsion 67%. Oil : straw coloured. Sp. Gr. 60°F.—0·776, Emulsion 95% oil
	..	21–10–27	Oil : Straw. Sp. Gr. 60°F.—0·779. Light oil
	..	22–10–27	Oil : Water white. Sp. Gr. 60°F.—0·776. Light oil
	..	24–10–27	Oil : Water white. Sp. Gr. 60°F.—0·783. Kerosene fraction
	..	5–11–27	Oil : Pale straw. Sp. Gr. 60°F.—0·780. Kerosene fraction
	..	5–11–27	Water Emulsion : Oil 0·6%
	..	7–11–27	Emulsion : Water white oil 99·5%, Emulsion 0·5%. Oil : Sp. Gr. 60°F.—0·774. Light mineral oil
	..	7–11–27	Water 87%, Oil 10%, Emulsion 3%
	..	10–11–27	Emulsion 3% : Oil 97% colourless. Sp. Gr. 60°F.—0·774
	..	10–11–27	Oil : Water white. Sp. Gr. 60°F.—0·776. Light mineral oil
	..	10–11–27	Water 61%, Oil 35%, Emulsion 4% (80% oil)
	..	15–11–27	Oil : Straw. Sp. Gr. 60°F.—0·774. Light mineral oil
	..	15–11–27	Oil : Straw. Sp. Gr. 60°F.—0·777. Light mineral oil
	..	26–11–27	Oil 99% : Water white. Sp. Gr. 60°F.—0·776. Light mineral oil
	..	28–11–27	Oil : Water white. Sp. Gr. 60°F.—0·779. Light mineral oil
	..	3–3–29	Oil : Sp. Gr. 21°C.—0·795, brown-black. Light mineral oil
	..	29–3–29	Oil : Sp. Gr. 21°C.—0·773, brown-yellow. Light mineral oil
	..	1–4–29	Oil : Sp. Gr. 21°C.—0·781, straw. Light mineral oil
	..	8–4–29	Oil : Sp. Gr. 21°C.—0·777, pale straw. Light mineral oil
	..	10–4–29	Oil : Sp. Gr. 21°C.—0·797, dark straw. Light mineral oil
R.O.C. No. 2 (Hospital Hill) ..	..	27–2–29	Weight of sample 9 ozs. Free oil 0·12% Weight of sample 16 ozs. Free oil 0·45% A brown-black mineral oil just poured at 25°C.
Ruthven No. 1	4,100	5–2–18	Petroleum wax. Petrolene 90%, Asphaltine 4·0%
		16–1–19	Petroleum wax. Yielded on distillation 84·2% of yellow oil and a darker coloured wax
		27–10–24	Contained 6·0% of a dark brownish-black mineral wax
		27–10–24	Contained brownish-black waxy material. Petrolene 96·9%, Asphaltine 2·6%
S.O.E. Scout Bore No. 2 (Canaway Downs)	898	25–9–58	Chloroform extract 46%—brown mineral oil with consistency of vaseline—fluoresced light blue
S.O.E. Scout Bore No. 3 (Gumbla)	1,155	14–7–59	Chloroform extract 74·0%—brown mineral oil with consistency of vaseline—fluoresced lilac. Also siliceous material and water
Springleigh No. 3	2,500	5–2–18	Petrolene 65·5%, Asphaltine 16·5%
	5,450	16–1–19	Hard black wax yielded on distillation 67·5% of clear yellow oil and wax
	5,450	3–10–19	Asphaltine 18·9%. Non-bitumenous organic 5·95%
	6,700	16–12–20	Petrolene 13·7%, Asphaltine trace
S.G.P. Scout No. 1 (Cribb Island)	406	24–2–58	Sludge gave 2% brown mineral oil, of consistency of vaseline
Talbalba	..	0–6–33	Sludge gave 60% mineral oil, which was brown and had the appearance and consistency of heavy lubricating oil
Tallyabra No. 1	2,034–2,051	13–2–25	450 gms. sludge contained 10 c.c. Light mineral oil
Wellington Point Oil Well No. 1 (Birkdale)	2,230	5–4–32	Sludge. Thin black oil with an odour resembling kerosene. Sp. Gr. 0·852 at 25°C. First drop 102°C.; 10%, 140°; 20%, 163°; 30%, 183°; 40%, 205°; 50%, 230°; 60%, 245°; 70%, 290°; 75%, 310°; gasoline 38°–207°C., Kerosene 200°–300° or 350° C. Cracking above 300°C.
Westland Water Bore No. 3 ..	..	20–4–27	Free oil 0·22%
		27–4–27	Heavy oil 2·3%
		27–4–27	Free oil 20·0%
W.O.L. No. 3 (Warbreccan) ..	3,300	15–8–55	Mineral oil .. .. 0·45%
	3,490	15–8–55	Mineral oil .. .. 0·32%
	3,920	15–8–55	Mineral oil .. .. 0·45%
	4,130	15–8–55	Mineral oil .. .. 0·14%
	4,155	15–8–55	Mineral oil .. .. 0·40%
	5,118	15–8–55	Mineral oil .. .. 0·60%
	5,124	15–8–55	Mineral oil .. .. 0·58%
	5,135	15–8–55	Mineral oil .. .. 0·46%
	5,148	15–8–55	Mineral oil .. .. 0·45%
	4,790	15–8–55	Mineral oil .. .. 1·0% The oil was brown in colour and had the consistency similar to that of diesel oil

TABLE V

WATER ANALYSES

Bore	Date	Column totals in grns. per gallon						Hardness (deg. Clark)
		Total solids	Sodium chloride	Alkalinity		Sulphates		
				Sodium carbonate	Calcium carbonate	Sodium sulphate	Calcium sulphate	
A.A.O. No. 2 (Roma) (3,200 ft.) ..	4–3–53	351·0	170·0	131·7	1·6	..	1·9	3·0
		Organic matter and solids in suspension				..	45·0	7·8Ph
A.A.O. No. 5 (Hospital Hill) ..	8–3–55	228·0	45·0	151·2	..	0·1	2·7	2·1
		Organic matter 22·0		Suspended solids 5·5		Mag. sulphate 0·1		7·8 Ph
Amby Downs (P. 61 Tullock)	28–2–28	72·8	35·8	9·2	..	23·4	..	1·5
(S.G. 55 Tullock)	28–2–28	1944	1,478	7·6	..	379	..	>550
A.R.O. No. 4 (Blythdale)	5–11–29	..	112·3	234	..	trace		..
Above 3,850 ft.	10–3–30	..	111·7	238	..	1·7	..	..
3,844–3,847 ft.	10–3–30	..	111·7	238	..	1·7	..	..
3,844–3,847 ft.	10–3–30	..	40·9	95·0	..	trace	..	..
3,844–3,847 ft.	22–3–30	176	125	39	..	3·0	..	..
A.R.O. No. 19 (Wallumbilla) ..	14–4–34	382	274·9	40·8	..	61·6	..	4
	14–4–34	342	147·8	178·0	..	8·5	..	2
	27–2–34	176	125	39	..	3·0	..	2
	20–4–34	336	224	67	..	36·5	..	4
Bald Hills (30 ft.), Brisbane ..	11–4–30	..	356·0	..	..	..	..	..
						Magnesia		
Beaudesert, Jenson's Bore	14–7–24	..	11·6	..	..	2·3	..	..
	14–7–24	..	13·9	..	..	2·4	..	..
Benyon's Bore	14–7–24	..	32·5	..	..	7·1	..	..
Ferguson's Bore	14–7–24	..	447·0	..	..	35·4	..	..
Ellery Bore	14–7–24	..	44·0	Alkalinity		5·1	Sulphates	..
Rosin's Bore	16–6–22	52	17·2	15·8	..	..	..	..
Dunn's Bore	8–6–22	41	8·6	30·4	..	..	0·3	31·0
						Sod. sulph.		
Beaufort No. 3	..	230	105	23	..	90	..	16
Beaufort No. 4, Roma	..	122	50·8	28·7	..	11·7	..	15
							Calc. sulph.	
Bishop's Bore, Toorbul Point (168 ft.)	7–6–37	1,639·0	1,559·0	..	5·0	..	67·8	..
Boonah, Philp's Spring	5–8–28	..	9	..	24	trace	..	..
Taylor's Spring	5–8–28	..	772	..	29	apprec.	..	..
Allandale Spring	5–8–28	..	911	..	42	apprec.	..	..
Borah Trust	12–7–27	..	5·0	..	36·0	..	..	..
				Calc. chlor.		Mag. chlor.		
Bowie—								
Ulcanbah No. 4	15–12–29	482	302	44	3	25	11	..
4 Mile	15–12–29	139	90	7	7	12	12	..
				Sod. carb.		Sod. sulph.		
B.A.O.S. No. 1 (Gatton)—								
Top Water	15–3–32	564	77·4	478·6	..	1·3	..	..
Bottom Water	15–3–32	494	57·8	430·0	..	0·3	..	..
				Chloride		Sulphate		
Burrum, drilling mud filtrate ..	24–4–51	..	..	91·8	..	10·2	..	..
				Sod. carb.		Sulphate		
Captains, Mountain, Millmerran ..	22–8–28	..	339	11·0	..	trace	..	15
Charleville, New Bore	18–11–24	..	8·1	..	13·7	..	..	..
Condamine Oil Ltd. (Speculation)	13–9–48	152·0	115·0	24·0	..	..	..	12
(250 ft.)	30–9–49	46·0	23·8	20·9	0·3	Mag. carb.	..	0·3
	30–9–49	150·0	124·4	13·1	6·0	2·5	2·3	11
				Mag. carb.		Mag. chlor.		
Cooper's No. 1 Well (Lowood) ..	18–8–35	340	75	21	12	202	18	260

TABLE V—*continued*

WATER ANALYSES—*continued*

Bore	Date	Column totals in grns. per gallon						Hardness (deg. Clark)
		Total solids	Sodium chloride	Alkalinity		Sulphates		
				Sodium carbonate	Calcium carbonate	Sodium sulphate	Calcium sulphate	
Crowman No. 22	15–1–28	..	260	..	14·4	..	..	..
	15–1–28	..	257	..	16	..	..	..
							Ferric oxide Alumina	
Dalby Town No. 1	1901	124·6	55·4	65·4	0·6	0·4	0·4	..
					Silica 2·3			
					Calc. carb.			
	1902	117	45·8	66·6	0·3	0·1	0·2	..
					Silica 1·3			
					Calc. carb.			
Deakin's Well, North Rockhampton	11–2–25	537	498	..	40·8	..	..	..
Elderslie—								
Bough Gunyah	9–6–28	274	219	..	6	42·0	..	15
Castle	9–6–28	316	289	..	10·4	1·2	..	35
Elderslie No. 1	9–6–28	53	5	40	..	1·2	..	0·5
Elderslie No. 2	9–6–28	29	3·9	20·1	..	1·4	..	0·5
Haines Creek	9–6–28	162	138	..	11·6	5·6	..	10·5
Top Horse	9–6–28	65	40	18·9	..	0·4	..	2·5
Torry	9–6–28	173	152	..	11·6	0·7	..	17
Woolshed	9–6–28	244	159	..	11·2	72	..	28
Yamala	9–6–28	592	543	..	4·4	18·7	..	> 60
Cattle Bore	23–11–28	490	427	..	4·2	35	..	55
New Salt Bore	23–11–28	530	462	..	3·4	26	..	55
Engine Ridge Bore	23–11–28	390	329	..	5·4	21	..	30
Eromanga No. 2	16–2–25	..	16·2	..	104·0	nil	..	
					Mag. sulph.			
Euthulla No. 3, Roma (315 ft.)	1910	287·3	197	11·8	16·3	18·5	35·5	..
					Calc. carb.			
Gartmore, Tambo	1–11–24	..	2·6	..	4·5	..	..	..
						Magnesia		
Hamilton, Royal Queensland Golf Club (70–87 ft.)	..	955	800	..	12·2	64·8	123·5	..
Heck's, Pimpama Island	12–6–35	4,242	3,719	..	14	..	441	..
						Ferric oxide		
Johnson's Bore, Rocklea	12–3–41	137·2	127·0	..	0·4	8·0	..	50
Kalbar—								
The Flat	30–6–28	1,440	1,247	..	12	59	..	> 800
Radunz Salt Bore	3–11–28	642	577	..	49·7	..	14·5	260
Kalgun, Fritze's Bore	31–10–27	..	507	..	..	..	..	..
L.O.A.L. No. 1 (Orallo) (273–533 ft.)	15–1–25	122	20	118	cement-bearing liquids after circulation			
L.O.A.L. No. 1 (Orallo) (750 ft.)	15–1–25	123	18	113				
			Chloride	Alkali	Carbonate	Sulphate		
L.O.A.L. No. 1 (Orallo) (900 ft.)	17–12–25	154	25	116	trace	trace	mud filtrates	
L.O.A.L. No. 1 (Orallo) (1,400 ft.)	17–12–25	140	25	109	trace	trace		
			Sod. chlor.	Sod. carb.				
L.O.A.L. No. 3 (Orallo)	26–7–26	..	4·1	8·6	..	..	..	..
					Calc. carb.			
L.O.A.L. Water Bore No. 5 (Orallo)	9–2–25	..	6·6	..	4·8	..	nil	..
Longreach Town Bore No. 1	6–2–25	76·8	13·7	57·0	..	trace		..
	17–5–29	1,163·2	1,057	..	11·6	..	78·8	210
L.O.W. No. 1 (Longreach) (2,910 ft.)	28–10–29	..	11·3	70·0	..	trace		..
Lyra Park, Emerald	23–8–26	..	125	..	14	..	..	..
Logan Downs, Clermont (957 ft.)	..	2,400	..	..	..	..	..	..

TABLE V—*continued*

WATER ANALYSES—*continued*

Bore	Date	Column totals in grns. per gallon						Hardness (deg. Clark)
		Total solids	Sodium chloride	Alkalinity		Sulphates		
				Sodium carbonate	Calcium carbonate	Sodium sulphate	Calcium sulphate	
McFarlane Downs Trial Oil Bore ..	..	3,850	1,459	..	Mag. chlor. 360	Calc. chlor. 245	250	..
				Calc. carb. 11·4	Insolubles 1,142·6	Alumina and Ferric oxide 354·8		..
Male's Bore, Tara	4–4–27	160	97	Sod. carb. 53	..	7	..	5·5
Maria Creek, Comet	14–4–43	847	214·5	565·0	Calc. carb. 23·0	Mag. carb. 38·8	..	70
Millmerran, Clontarf Council Bore ..	12–8–26	..	162	..	21	..	..	..
Murilla Oil Co. No. 1 (Boyanda) ..	19–11–35	998	804	..	27	..	156	180
	9–1–36	84	50·8	23·1	..	trace		2·5
	11–12–38	612	552	58·4	..	trace		7·5
Norwood, Wallumbilla (794 ft.) ..	30–7–52	164·2	117·1	40·9	1·1	..	..	1
Oakley No. 1, Longreach	21–2–25	80·0	13·4	55·8	..	..	..	0·5
	21–2–25	88·2	17·0	61·5	..	Sod. sulph.	..	0·5
	21–2–25	659	416	21·3	..	162	..	>90
Oil Search Ltd. No. 1 (Warooby) ..	10–9–34	118·3	47·4	55·0	..	9·0	..	25
	8–7–35	147·7	72·3	70·2	..	1·2	..	3
	8–7–35	168	65·2	95·4	..	1·0	Mag. carb.	30
	24–3–52	264·0	9·8	47·4	4·7	..	0·3	5·0
			Suspended solids 144·5		..	Organic matter 56·0		7·9 Ph
Q.C.O.C.(N.) No. 1 (Tewantin) (650 ft.)	22–7–24	..	3·5	..	..	..	..	..
Q.C.O.C. No. 5 (Tewantin)	25–3–24	11·2	5·0	5·9	Lime trace	Magnesia trace	..	..
Queensland Oxygen Co., Newstead ..	30–6–36	1,367	Chloride 770	..	170	114	Sulphates 41·2	..
Whinstanes	28–7–36	41·2	Sod. chlor. 18·2	Mag. carb. 3·6	3·5	..	1·4	12·0
		..	..	..	..	..	..	7·4 Ph
Queensland Government No. 4 (Hospital Hill), Water issuing with gas in 8 in. casing	3–9–20	..	12·9	40·2	..	..	..	..
	13–9–20	..	16·2	43·0	..	..	..	..
Sample from bailer taken at 3,000 ft.	20–9–20	70·0	5·9	25·4	..	2·4		..
			Silica	Ferric oxide	Lime, magnesia		Suspended	
		..	0·8	0·1	trace		24·3	..
Water flowing between 15½ in. and 12½ in. casing	19–11–20	36·0	Sod. chlor. 5·9	28·0 Silica	trace Mag. carb.	1·2 Ferric oxide and Alumina		..
				1·1	trace	trace		
Inside 10 in. casing	22–11–20	50·6	9·1	Sod. carb. 37·1 Silica	trace Mag. carb.	0·35 Ferric oxide and Alumina		
				1·4	trace	0·6		..
Water from inside 10 in. casing, filtered	14–12–20	49·6	8·7	Sod. carb. 33·9 Silica	1·1 Mag. carb.	1·5 Ferric oxide and Alumina	..	..
		..	..	2·3	trace	trace		..

TABLE V—*continued*

WATER ANALYSES—*continued*

Bore	Date	Column totals in grns. per gallon						Hardness (deg. Clark)
		Total solids	Sodium chloride	Alkalinity		Sulphates		
				Sodium carbonate	Calcium carbonate	Sodium sulphate	Calcium sulphate	
Q.G. No. 4 ((Hospital Hill)—*cont'd.* Water flowing at surface from inside of 10 in. casing taken every 48 hours from 20–12–20	20–12–20–		Chlorine		Alkalinity			
	14–1–21	..	5·6	..	33·2	..	..	..
		..	5·5	..	33·3	..	..	..
		..	5·3	..	33·6	..	..	..
		..	5·3	..	33·6	..	..	..
		..	5·2	..	33·2	..	..	..
		..	5·3	..	33·6	..	..	..
		..	5·3	..	33·8	..	..	..
		..	5·3	..	32·6	..	..	..
		..	5·3	..	33·4	..	..	..
		..	4·8	..	33·3	..	..	..
		..	4·8	..	34·0	..	..	..
	17–1–21–							
	31–1–21	..	4·6	..	33·6	..	..	..
		..	4·6	..	33·8	..	..	..
		..	4·6	..	33·8	..	..	..
		..	4·6	..	33·8	..	..	..
		..	5·2	..	34·8	..	..	..
		..	5·2	..	35·0	..	..	..
		..	5·2	..	35·0	..	..	..
	12–2–21–							
	23–2–21	..	5·3	..	34·6	..	..	..
		..	5·4	..	34·6	..	..	..
		..	5·4	..	34·6	..	..	..
		..	5·4	..	34·6	..	..	..
		..	4·4	..	33·6	..	..	..
		..	8·4	..	38·8	..	..	..
			Sod. chlor.					
Q.R.O. No. 1 (Gubberamunda) (2,774–2,789 ft.)	10–3–30	..	19·6	63·8	..	..	..	..
R.B.O. No. 1 (Mount Bassett) ..	9–11–30	..	135·0	170·0	..	nil		..
	15–7–37	329	158	163	..	trace		4 Ph
	21–8–37	301	141	153·6	..	3·6	..	8·5
	21–8–37	315	147	163·2	..	3·5	..	5
								6
R.B.O. No. 2 (Mount Bassett) ..	2–5–39	476·2	113·8	340·0	..	6·7	..	7
	2–5–39	474·6	113·8	340·0	..	6·7	..	7
	3–5–39	414·2	111·5	300·2	..	6·7	..	7
R.B.O. No. 3 (Mount Bassett) ..	7–5–40	156·8	50·7	89·6	..	..	14·7	4
(below 3,547 ft.)	7–5–40	261·8	106·6	143·3	..	..	5·8	7
		270·2	111·9	149·1	..	..	5·8	7
	20–5–40	46·4	14·9	27·0	..	4·0	..	2
	20–5–40	110·6	33·0	66·0	..	9·3	..	4
	7–5–40	196·0	88·4	97·0	..	8·8	..	5
	7–5–40	105·0	35·6	54·0	..	14·0	..	4
R.B.O. No. 4 (Mount Bassett) below 3,459 ft.)	17–3–41	..	69·3	66·4	..	..	..	..
	29–4–41	299·6	173·2	121·8	..	2·4	..	7 Ph
	29–4–41	303·8	175·5	123·2	..	2·4	..	8·5
		301·0	174·4	121·8	..	2·4	..	8
								8
R.O.C. No 1 (Hospital Hill) ..	16–9–27	..	8·0	(Condensate from Christmas Tree)				
	16–9–27	..	15	(Sludge)				
	13–10–27	..	200	(Sludge)				
	..	..	200	(Scum from 6 gallon)				
	14–10–27	..	200	(Salty water)				
	..	..	200	(Water and emulsion)				
	..	..	200	(" Oil " from tank)				
	15–10–27	..	196	(Oily, milky mud fluid)				
	..	..	200	(Emulsion)				
	16–10–27	..	209	(Oily, milky mud fluid)				
	..	..	200	(Mud fluid)				
	..	..	210	(Oil and water mixture)				
	..	..	200	(Emulsion)				

TABLE V—*continued*

WATER ANALYSES—*continued*

Bore	Date	Column totals in grns. per gallon							Hardn (deg. Clark)
		Total Solids	Sodium chloride	Alkalinity		Sulphates			
				Sodium carbonate	Calcium carbonate	Sedium sulphate	Calcium sulphate		
R,O.C, No. 1 (Hospital Hill)—*continued*	17–10–27	..	200	(Water)					
	..	..	200	(Oil and water)					
	18–10–27	..	198	(Salty water and emulsion)					
	19–10–27	..	200	(Emulsion)					
	21–10–27	..	196	(Brackish water)					
	5–11–27	..	200	(Water emulsion)					
	7–11–27	..	206	(Oil emulsion and water)					
	1–10–27 and 7–11–27	..	160	(Sludge)					
	10–11–27	..	211	(Water)					
	10–11–27	..	209	(Water under oil emulsion in tank)					
	..	..	216	(Oil and emulsion)					
	15–11–27	..	213	(Water discharged after oil)					
	..	..	213	(Water)					
	26–11–27	372	207	94·0	2·5	nil	..		2
	28–11–27	363	193·2	89·1	2·8	3·1	..		3
	15–12–27	354	209	92	..	0·7	..		..
	2–2–28	..	210	..	..	..	..		..
	11–2–28	..	214	..	..	..	..		12·5
	7–8–28	369	206	93	..	trace			3
	..	384	213	95	..	trace			3
Sprayed from Christmas Tree tubing	9–4–29	376	226	96	..	trace			1·5
	15–4–29	375	222	96	..	trace			1·5
	4–6–29	345	244·9	83·1	..	..		8·1	10
At 3,700 ft. (water flowing from tap on lead to meter)	27–6–29	355	213	98	..	..	..		2·5
	4–8–29	..	213·7	92·7	..	trace			..
	7–8–29	369	206	93	..	trace			3
Artesian water	22–3–30	..	13·1	..	16·8	nil			..
R.O.C. No. 2 (Hospital Hill), 3,600–4,000 ft.	14–3–29	343	247·5	79·3	3·6	8·5	..		2·5
			Silica	Ferric oxide	Mag. carb.				
	14–3–29	..	1·5	0·1	0·6	..	..		..
R.O.C. No. 3 (Hospital Hill)—			Sod. carb.	Sod. carb.					
Before shot, 1–5–30	14–5–30	..	58·5	48·7	..	trace			..
After shot, 4–5–30	..	..	209·0	95·4	..	trace			..
R.O.C. No. 4 (Blythdale)	9–11–30	..	123	219		nil			..
					Calc. carb.				
Roma Town Water Bore (artesian)	0–8–01	37·83	6·93	26·07	0·38	2·31	..		..
			Silica	Ferric oxide	Mag. carb.				
	..	..	1·82	0·18	0·14	..	..		.
			Sod. chlor.	Sod. carb.	Calc. carb.				
Roma Town Water Bore No. 1, from flows 900–1,360 ft.	28–9–20	40·4	9·6	26·4	trace	2·2			..
			Silica	Ferric oxide	Mag. carb.				
	..	..	0·8	0·2	trace	..	..		..
			Sod. chlor.	Sod. carb.	Calc. carb.				
Roma Town Water Bore No. 2, probably mixture of all water from 900–3,700 ft.	28–9–20	42·4	10·7	26·7	trace	..	..		..
			Silica	Ferric oxide	Mag. carb.				
	..	..	0·9	0·2	trace	2·8			..
			Sod. chlor.	Sod. carb.	Calc. carb.				
Roma Town Water Bore No. 3, probably from waters 900–1,338 ft.	28–9–20	43·6	10·2	27·2	trace				
			Silica	Ferric oxide	Mag. carb.				
	..	..	0·9	0·1	trace	2·9			..
			Sod. chlor.	Sod. carb.	Calc. carb.				
Roma Town Water Bore No. 4 (depth 1,620–1,643 ft.). Water coming up between the 10 in. and 12½ in. casings presumably from sandstone at 2,663–2,740 ft.	16–4–17	78·0	25·6	45·6	1·2	..	..		1·5
						Silica	Ferric oxide		Mag. carb.
	..	..	..	..	..	1·2	0·6		trace
	12–7–20	57·3	12·9	42·1	0·5	1·5	0·3		trace
	3–9–20	..	7·8	40·2		..	..		..

TABLE V—*continued*

WATER ANALYSES—*continued*

Bore	Date	Column totals in grns. per gallon						Hardness (deg. Clark)
		Total solids	Sodium chloride	Alkalinity		Sulphates		
				Sodium carbonate	Calcium carbonate	Sodium sulphate	Calcium solphate	
Water between 15½ in. and 12 in. casing) i.e. from waters between 900 ft. and 1,400 ft.	28–9–20	35·6	5·8	29·0	trace	..	..	..
			Silica	Ferric oxide	Mag. carb.			
	..	..	0·9	0·1	trace	0·7		..
			Sod. chlor.	Sod. carb.	Calc. carb.		Silica	
Roma Bore (from inside 10 in. casing)	25–1–21	49·6	8·7	33·9	..	1·5	2·3	..
Ruthven No. 1	27–10–24	..	5·8	65·0	..	1·68		..
Salt Domes Oil Syndicate No. 2 (Boonah)	15–9–28	..	278	trace	..	5·0	..	..
Sapphire Well	31–5–20	66·8	19·6	35·0		..	..	33·6
	31–5–20	50·4	11·5	35·0		..	..	33·6
Schiowes, Tenthill	..	589·0	439·0	..	79·8	..	65·3	>100
Scouller's Bore—								
178 ft.	14–1–16	1,995	1,780	..	15·5	nil		..
415 ft.	14–1–16	1,165	1,107·6	..	2·6	nil		..
915 ft.	14–1–16	419	346	..	52	..	..	7·5
Smith's, Terry	20–10–30	716·0	..	..	66·0	38·0	..	..
Spanglers	4–9–44	336	273·2	..	47·6	..	12·2	123
			Chloride equiv. NaCl	Calcium as CaO	Magnesium as MgO	Sulphur trioxide		
S.G.P. Scout No. 1 (Cribb Island) ..	14–4–58	3,310	3,040	185	254	62		896
			Sod. chlor.	Sod. carb.	Calc. carb.	Mag. carb.	Ferric oxide	
Tabragalba No. 2	4–9–44	40·0	3·6	7·2	7·5	9·5	1·2	19
					Mag. sulph.			
Talaroo Hot Spring	7–9–47	50·0	28·4	11·2	0·3	3·0	6·5	5
					Calc. carb.			
Tallyabra No. 1 (2,583 ft.)	..	..	1,032	..	11·4	3·5		..
Tara Town Bore—								
150 ft.	..	..	1,120	..	..	..	..	..
180 ft.	..	..	bitter	..	..	..	..	..
388 ft.	..	..	brackish	..	..	..	..	..
480–486 ft.	..	..	71·5	..	..	..	..	..
Tarbon No. 4	9–7–25	175	142	..	39	..	..	12
Ten Mile Swamp, Ipswich (215 ft.)	16–11–48	1,001·0	762·8	..	42·0	..	51·3	227
				Calc. chlor.		Mag. chlor.		
				46·7	..	96·8	..	..
						Sod. sulph.		
Waldegrave No. 6	7–11–28	90	48·5	..	19·6	18·6	..	9·0
Waldegrave No. 7	7–11–28	88	42·7	..	25·9	15·8	..	3·0
Waldegrave No. 8	23–11–28	88	41·6	..	22·4	19·8	..	7·0
Warbreccan (flowing bore) (2,238 ft.)	29–10–28	140	19·6	94·2	..	9·0	..	2·5
	2–4–32	73	45·0	25·0	..	..	..	..
Wellington Point Oil Wells Ltd.	4–4–32	64·4	35·2	22·7	..	..	2·2	17
No. 1, 2772 ft.	16–8–32	173·6	83·1	83·5	..	1·8	..	7
3,742 ft.	12–9–33	2,772	86·6	83·1	..	trace		2.
					Suspended 2592·0			
Wellshot No. 4	28–10–24	..	16·1	..	34·4	.. nil		..

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S. G. Reid, Government Printer, Brisbane

QUEENSLAND

PETROLEUM AND NATURAL GAS OCCURRENCES

Prepared at the Geological Survey of Queensland

SCALE OF MILES

100 50 0 100 200

Drawn at the Department of Mines Brisbane by J.S.Douglas 31/12/59

LEGEND

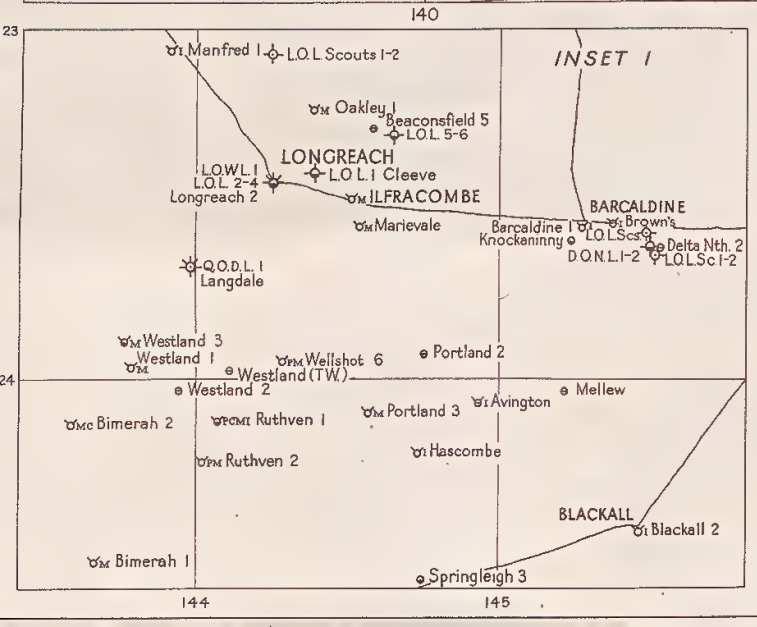
- Surface contact between sedimentary basin and basement; position approximate.
- Surface contact between sedimentary basin and basement; position inferred.
- Dry oil hole.
- Dry oil hole with show of oil.
- Dry oil hole with show of gas.
- Dry oil hole with show of oil and gas.
- Abandoned gas and oil well.
- Water bore with show of oil or wax confirmed by analysis,
- Water bore with show of gas confirmed by analysis.
  - P Petroliferous gas.
  - M Gas mainly methane.
  - C Gas mainly carbon dioxide.
  - I Gas mainly inert.
- Water bore with reported show of oil or gas not confirmed by analysis, but considered to be authentic.
- Spring with show of gas.
  - M Gas mainly methane.
  - C Gas mainly carbon dioxide.
  - I Gas mainly inert.

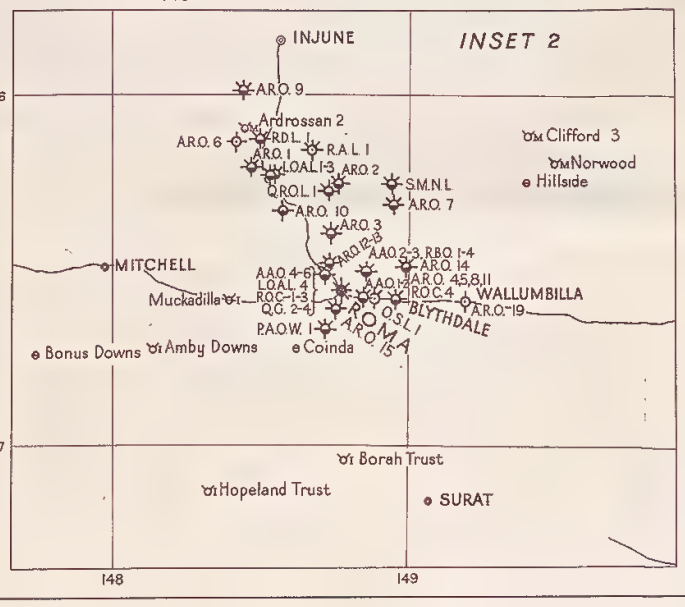
N.B. For clarity, adjacent holes and bores are represented by one symbol only, signifying the most important occurrence of oil and gas in the group.

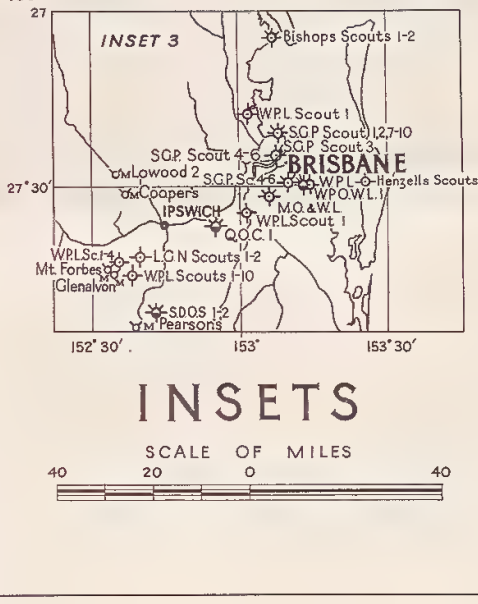
WEIPA Z.C.L. 1
LAURA BASIN
LAURA
COOKTOWN
CARPENTARIA
MORNINGTON ISLAND
S.D.A. Scouts 3-19A
F.B.H. 1
WROTHAM PARK
CAIRNS
Vanrook
SUB-BASIN
A.A.O. 8
BURKETOWN S.D.A. Scouts 1-2A
NORMANTON
Innot Hot Springs
Inverleigh West
CROYDON
FORSAYTH
RIDGE
EUROKA
GEORGINA BASIN
TOWNSVILLE
BOWEN
CLONCURRY
Katnock
Julia Creek
MT. ISA
Arolla Downs
HUGHENDEN
Toorak 4
Eulolo
ROMANCA
Wetherby 2
Glenariffe
Lake Buchanan
Cairnhope 2
Elderslie 1
Wyora
Ulcanbah
P.O.P.L. Scout 1 Cockatoo 1
M.O.P.S. Scouts 4-5
MACKAY
W.C.W. Scouts 1-3
M.O.P.S. Scouts 1-3
WINTON
O.P.L. 1
Ashra Downs
Kingsborough
Stainburn
Darr R. Downs 4
Evesham 1
ARAMAC
CLERMONT
M.P.P.S. Scout 1
Lucknow 10
BOULIA
Warenda
A.F.O. Cooroorah 1
Daniels 4
M.P.P.C. 1
ROCKHAMPTON
WRECK ISLAND
H.B.R. 1
HERON ISLAND
LONGREACH
BARCALDINE
EMERALD
BLACKWATER
COMET
Maria Creek
GLADSTONE
SPRINGSURE
S.Q.D.S. Scouts
SOMERBY
BEDOURIE
W.O.L. 3
W.O.L. 1-2
Warbreccan 1
BLACKALL
INSET 1
MANTUAN DOWNS
ROLLESTON
A.O.E. 3
BANANA
YARAKA
Enniskillen 2
Macfarlane 1
Hodinottes
Gartmore
S.P.L. 1
TAMBO
Malta O.C. 1
Ravensborne 4
A.O.E. 1
A.O.E. 2
INGELARA
WARRINILLA
S.Q.D. 1
S.Q.D. Scouts
THEODORE
CAMBOON
IPPS 1
OSL 3
A.A.O. 7
CRACOW
Lynfield 2
WINDORAH
D.F.S. Betoota 1
Bulgroo 1
Daly's Bore Bulgroo
Terrachie
S.O.E. Scout 2
S.O.E. Scout 1
OSL 2
Cockatoo Ck
Red Range Ck
INJUNE
WANDOAN
Q.C.O.C. N 1
Q.C.O.C. 1-5
MARYBOROUGH
MARYBOROUGH BASIN
Boothulia
CHARLEVILLE
NEBINE RIDE
ROMA
WALLUMBILLA
BLYTHDALE
Murilla O.C. 1
C.O.L. 1
W.P.L. Scout 1
WPL Scouts 1&2
EROMANGA
Eromanga 1-2
QUILPIE
Cowley Downs
S.O.E. Scout 3
Scoullers
Benders
Browns
Scouts 1-2
CHINCHILLA
BRIGALOW
A.R.O. 21
Beutels
C.R.O. Scouts 1-4
W.P.L. Scouts
Boatman 10
Toompine
SURAT
Homeboin
Males
DALBY
A.R.O. 20
INSET 2
D.F.S. Innamincka 1
A.O.G. 2
TOOWOOMBA
G.C.S. 1
B.A.O.S. 1
Gardners
IPSWICH
BRISBANE
Moonjaree 1
EULO
CUNNAMULLA
SURAT SUB-BASIN
Whyenbah Trust
Kauwanna Trust
Wycanna Trust
Captains Mt.
INSET 3
BTB 1
B.O.P. 1
A.O.C. 1-2
BEAUDESERT
B.B.C. 1
MORETON BASIN
DIRRANBANDI
Thurrulgoona
Talbalba
A.O.G. Scouts 1-2

140 145 150

10 15 20 25







INSETS

SCALE OF MILES

40 20 0 40

EAST — WEST SECTIONS ACROSS THE GREAT ARTESIAN BASIN

	CAINOZOIC SEDIMENTS	
	CAINOZOIC BASALTS	
	WINTON FORMATION	CRETACEOUS
	ROMA AND TAMBO FORMATIONS	CRETACEOUS
	BLYTHESDALE GROUP	
	WALLOON COAL MEASURES	JURASSIC
	MARBURG FORMATION	TRIAS-JURA
	BUNDAMBA GROUP	TRIASSIC
	MOOLAYEMBER SHALE	TRIASSIC
	CLEMATIS SANDSTONE	TRIASSIC
	BOWEN GROUP	PERMIAN
	PRE-BOWEN	MAINLY CARBONIFEROUS
	BEDROCK	

Horizontal Scale of Miles

40 20 0 40 60 120

Vertical Scale of Feet

0 4000 8000 12000 16000

Sections taken from Fig. 19 of "The Geology of the Queensland Portion of the Great Australian Artesian Basin" by E. W. Whitehouse, PhD., D.Sc. (Department of Co-ordinator General of Public Works, 1954)

CARPENTARIA

SUB-BASIN

EUROKA RIDGE

NORTHERN TERRITORY

SHELF

BOULIA

EROMANGA

SUB-BASIN

RIDGE

SURAT

SOUTH AUSTRALIA

LAKE EYRE

EULO

SHELF

NEBINE RIDGE

SUB-BASIN

NEW SOUTH WALES

Burketown · NORMANTON · Cloncurry · Georgetown · Croydon · Carlsgoe · CAIRNS · INNISFAIL · TOWNSVILLE · CHARTERS TOWERS · BOWEN · CAMOOWEAL · MT. ISA · CLONCURRY · JULIA CK. · RICHMOND · McKinlay · Urandangi · WINTON · MUTTABURRA · BOULIA · LONGREACH · BARCALDINE · CLERMONT · EMERALD · ROCKHAMPTON · SPRINGSURE · GLADSTONE · BLACKALL · MONTO · BUNDABERG · MARYBOROUGH · GYMPIE · Windorah · Birdsville · AUGATHELLA · CHARLEVILLE · QUILPIE · ROMA · MILES · DALBY · TARA · TOOWOOMBA · BRISBANE · THARGOMINDAH · CUNNAMULLA · ST GEORGE · DIRRANBANDI · Thallon · GOONDIWINDI · STANTHORPE · TEXAS · Bonshaw · MOREE · MACKAY · MARREE

MSL

FIG. 3

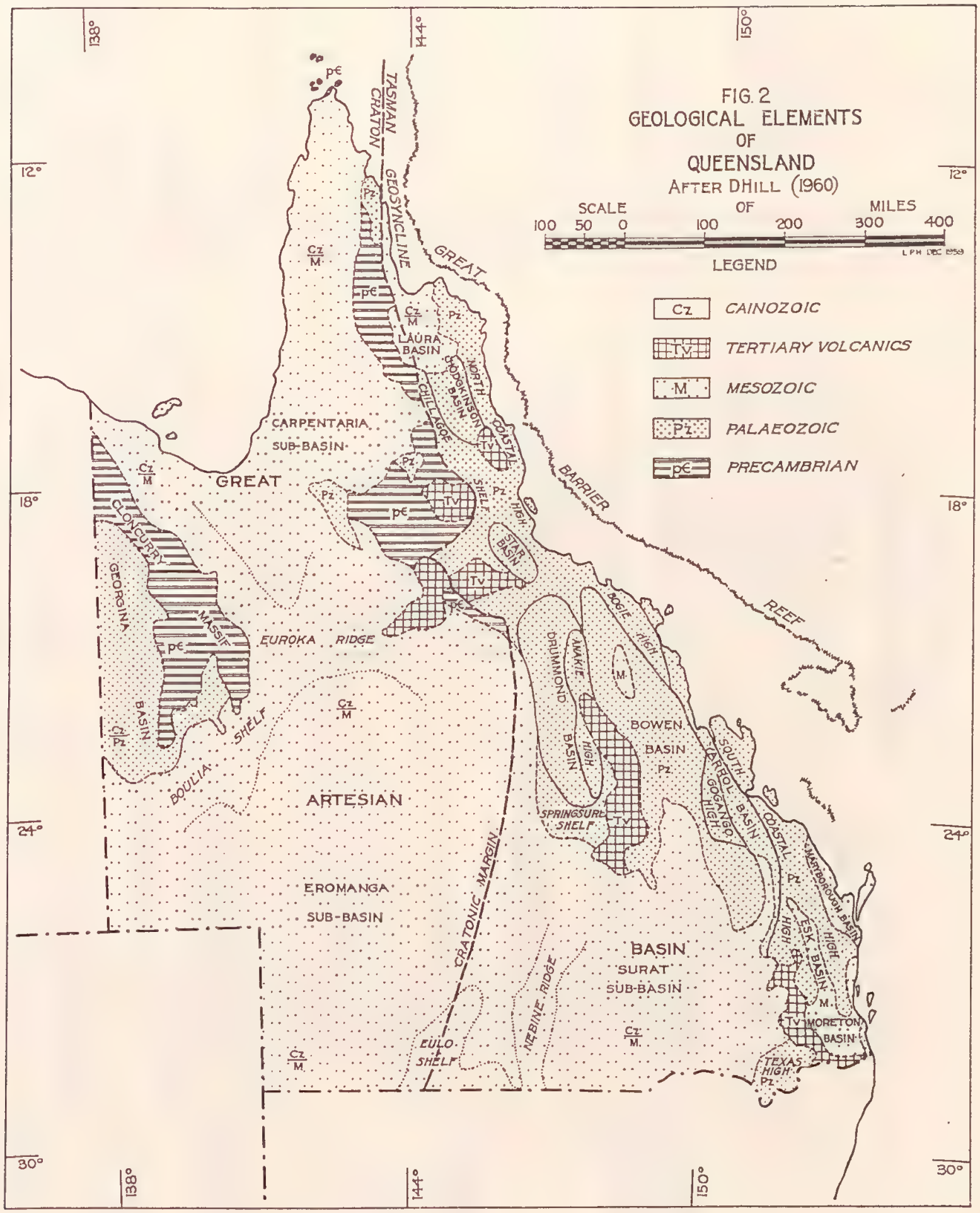


FIG. 2
GEOLOGICAL ELEMENTS
OF
QUEENSLAND
AFTER DHILL (1960)
SCALE OF MILES
100 50 0 100 200 300 400
LPH DEC 1959
LEGEND
Cz CAINOZOIC
Tv TERTIARY VOLCANICS
M MESOZOIC
Pz PALAEOZOIC
pЄ PRECAMBRIAN
138°
144°
150°
12°
18°
24°
30°
TASMAN GEOSYNCLINE
TASMAN CRATON
GREAT BARRIER REEF
LAURA BASIN
CHILLAGOE
GODKINSON BASIN
NORTH COASTAL
SHELF
HIGH
STAIN BASIN
CARPENTARIA
SUB-BASIN
GREAT
CLONCURRY
GEORGINA
MASSIF
BASIN
EUROKA RIDGE
BOULIA SHELF
ARTESIAN
EROMANGA
SUB-BASIN
CRATONIC MARGIN
EULO SHELF
NEBINE RIDGE
SURAT
SUB-BASIN
BASIN
SPRINGSURE SHELF
DRUMMOND BASIN
HIGH
BOWEN BASIN
BOGIE HIGH
MAKIE
SOUTH TARROL BASIN
GOGANGO HIGH
COASTAL
MARYBOROUGH BASIN
ESK BASIN
HIGH
MORETON BASIN
TEXAS HIGH

FIGURE 4

STRATIGRAPHIC LOGS

VERTICAL SCALE OF FEET

400 200 0 400 800 1200 1600

L.P.H. MAR 1960

A.A.O. Nº1 (ROMA)

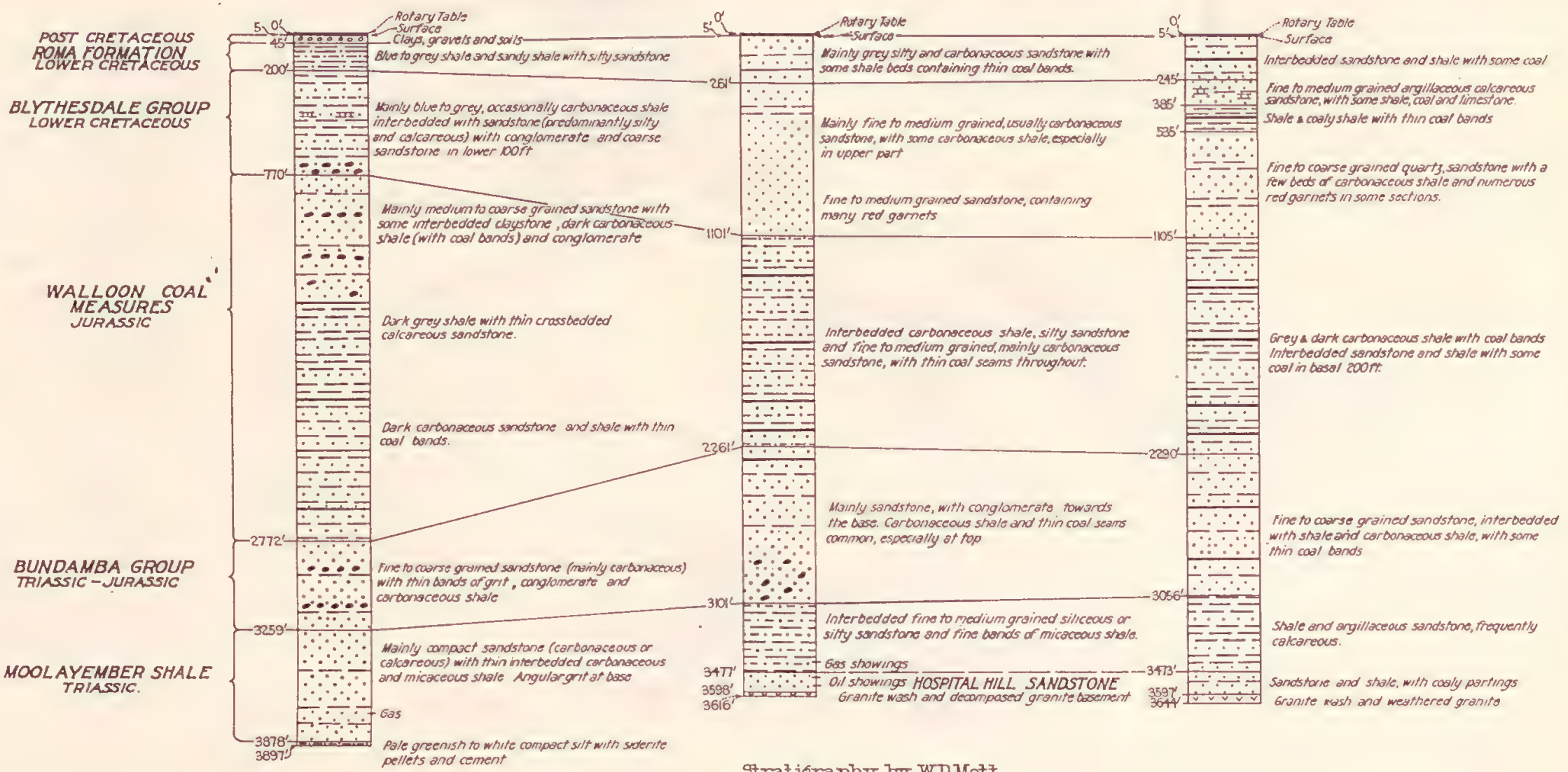
Location 34 chains N.W. from S.E. corner of Portion 148
Parish of Roma.
Drilled by Associated Australian Oilfields N.L.
Drill Sullivan 300A. Period 20-3-52 to 10-8-52.
Rotary Table Elevation 1128 ft. Height of Rotary Table 5ft.

A.A.O. Nº2 (ROMA)

Location: Portion 473 Parish of Euthulla ¼ mile East of R.B.O Nº4, ¾ mile South of R.B.O Nº1 and 6·7 miles N.N.E of Roma.
Drilled by Associated Australian Oilfields N.L.
Drill Sullivan 300A. Period 6-10-52 to 3-2-53
Rotary Table Elevation 1097 ft. Height of Rotary Table 5ft.

A.A.O. Nº3 (ROMA)

Location 103° (mag) and distant 40 chains from N.W. corner of Portion 473 Parish of Euthulla.
Drilled by Associated Australian Oilfields N.L.
Drill Sullivan 300A Period 4-8-53 to 26-11-53
Rotary Table Elevation 1090ft Height of Rotary Table 5ft.


POST CRETACEOUS
ROMA FORMATION
LOWER CRETACEOUS
BLYTHESDALE GROUP
LOWER CRETACEOUS
WALLOON COAL MEASURES
JURASSIC
BUNDAMBA GROUP
TRIASSIC – JURASSIC
MOOLAYEMBER SHALE
TRIASSIC.
5'
0'
Rotary Table
Surface
45'
Clays, gravels and soils
200'
Blue to grey shale and sandy shale with silty sandstone
710'
Mainly blue to grey, occasionally carbonaceous shale interbedded with sandstone (predominantly silty and calcareous) with conglomerate and coarse sandstone in lower 100ft
Mainly medium to coarse grained sandstone with some interbedded claystone, dark carbonaceous shale (with coal bands) and conglomerate
Dark grey shale with thin crossbedded calcareous sandstone.
2261'
Dark carbonaceous sandstone and shale with thin coal bands.
2772'
Fine to coarse grained sandstone (mainly carbonaceous) with thin bands of grit, conglomerate and carbonaceous shale
3259'
Mainly compact sandstone (carbonaceous or calcareous) with thin interbedded carbonaceous and micaceous shale Angular grit at base
Gas
3878'
3897'
Pale greenish to white compact silt with siderite pellets and cement
261'
Mainly grey silty and carbonaceous sandstone with some shale beds containing thin coal bands.
1101'
Mainly fine to medium grained, usually carbonaceous sandstone, with some carbonaceous shale, especially in upper part
Fine to medium grained sandstone, containing many red garnets
Interbedded carbonaceous shale, silty sandstone and fine to medium grained, mainly carbonaceous sandstone, with thin coal seams throughout.
3101'
Mainly sandstone, with conglomerate towards the base. Carbonaceous shale and thin coal seams common, especially at top
Interbedded fine to medium grained siliceous or silty sandstone and fine bands of micaceous shale.
3477'
Gas showings
3598'
Oil showings HOSPITAL HILL SANDSTONE
3616'
Granite wash and decomposed granite basement
245'
Interbedded sandstone and shale with some coal
385'
Fine to medium grained argillaceous calcareous sandstone, with some shale, coal and limestone.
535'
Shale & coaly shale with thin coal bands
Fine to coarse grained quartz sandstone with a few beds of carbonaceous shale and numerous red garnets in some sections.
1105'
Grey & dark carbonaceous shale with coal bands Interbedded sandstone and shale with some coal in basal 200ft.
2290'
Fine to coarse grained sandstone, interbedded with shale and carbonaceous shale, with some thin coal bands
3056'
Shale and argillaceous sandstone, frequently calcareous.
3473'
Sandstone and shale, with coaly partings
3597'
Granite wash and weathered granite
3614'

Stratigraphy by W.D. Mott

FIG. 5

STRATIGRAPHIC LOGS

A.A.O. No.4 (HOSPITAL HILL)

Location: Cnr. Bowen & Cottel Sts., Hospital Hill, Roma.
Drilled by Associated Australian Oilfields N.L.
Drill: Sullivan 300A. Period 14·1·54 to 22.7.54
Rotary Table elevn 1040'. Ht. of Rotary Table 5'

A.A.O. No.5 (HOSPITAL HILL)

Location: 800'S.W. from N.E. cor. Por 79, Town of Roma.
Drilled by Associated Australian Oilfields N.L.
Drill: Sullivan 300A. Period 9·8·54 to 15·3·55
Rotary Table elevn 1024'. Ht. of Rotary Table 5'

A.A.O. No. 6 (HOSPITAL HILL)

Location: 326'(Mag) 82 ft. from S.E. cnr. R2 Tn of Roma.
Drilled by Associated Australian Oilfields N.L.
Drill: National T.32. Period 7·6·55 to 3·8·55
Rotary Table elevn 1005'. Ht. of Rotary Table 10'

SCALE OF FEET 1000 500 0 1000 2000 — J.A.W. 25.7.56

BLYTHESDALE GROUP — ROMA FORMn — U. Jurassic to Lower Cret.

WALLOON COAL MEASURES — Lower and Middle Jurassic

MOOLAYEMBER SHALE — BUNDAMBA GROUP — Mid. Triassic Upper Triassic

A.A.O. No.4 (HOSPITAL HILL)		A.A.O. No.5 (HOSPITAL HILL)		A.A.O. No. 6 (HOSPITAL HILL)	
Rotary Table / Surface		Rotary Table / Surface		Rotary Table / Surface	
00' / 05'	Dark grey mudstones & shales & some interbedded fine argillaceous & calcareous shales.	00' / 05'	Light grey mudstone & sandy mudstone with some interbedded fine calcareous sa.	00' / 18'	
290'		290'		310'	
Transition Stage	Mainly grey mudstones, dark shales & f. gr. argillaceous sa. with some thin impure limest.		Mainly light grey mudstone, sandy mudstone & fine grey sa. with some impure limestone. F.-gr. argillaceous sa at top to coarse sa. at base.		
535'		505'			
Mooga Sandst.	Fine to med-gr. argillaceous sa. with some dk. grey mudstone & sh.				
720' / Fossil Wood Stage.	Mainly grey carb. & coaly sh. with some fine grey argill. sa	730' / 825'	Mainly grey shales, partly carb.		
850' / Gubberamunda Sandstone	Fine to med. to coarse grained quartzose sa. with some shale bands. Red garnet in basal 100 ft.		Fine argillaceous & med to coarse gr. sa., friable, with some shaley bands. Red garnet & pale blue zircon common in basal 100'		
1360'		1327'		1385'	
	Interbedded fine white to grey sa. and grey carbonaceous shales. Thin coal bands common.		Mainly interbedded lt. to dk. grey carb. shales with some thin coaly bands & lt. grey f.-gr. carbonaceous sa. Red garnet & heavy minerals abundant in interval 2540'-2650'.		No lithology recorded – Similar to A.A.O.5
2675'		2700'		2710'	
	White med. to coarse grained sa. with minor light to dark grey carb. shales & sandy shales in part coaly. Heavy minerals between 3,100' & 3,220'.		Med.-grained, poorly cemented sa. with some light grey to dark carbonaceous shales & sandy shales. Abundant red garnet at 3,300'.		White fine to med.-gr. sa. interbedded with dark grey shale & sandy shale. Minor thin bands of coal.
3295'		3328'		3350'	
	Light to dark grey carb. shales & sandy shales & white to grey fine to med.-gr. sa. Plant remains near base. Gas at 3505', 3630', & between 3701' & 3717', & at 3820'		Light to dark grey carbonaceous shales, sandy shales & fine to med.-gr. sa., occasionally carbonaceous & micaceous. Minor coal bands & conglomerate at base. Gas between 3625' & 3710' & at 4010'		Mainly white fine to med.-gr. quartzose sa. & dark grey carbonaceous shales & sandy shales. Numerous thin bands of coal & a band of conglomerate at 3950
3683' / Hospital Hill Sandst. 3882' / 3891'	Basement: decomposed metamorphic rocks.	3700' / 4070' / 4079'	Basement: Light green & green-grey indurated shales, mudsts, & siltstones.	3708' / 4209' / 4285'	Basement: Hard indurated black & green shale & hard white quartzose sa.

Stratigraphy by S.S. Derrington & P.H.J. Hammett.

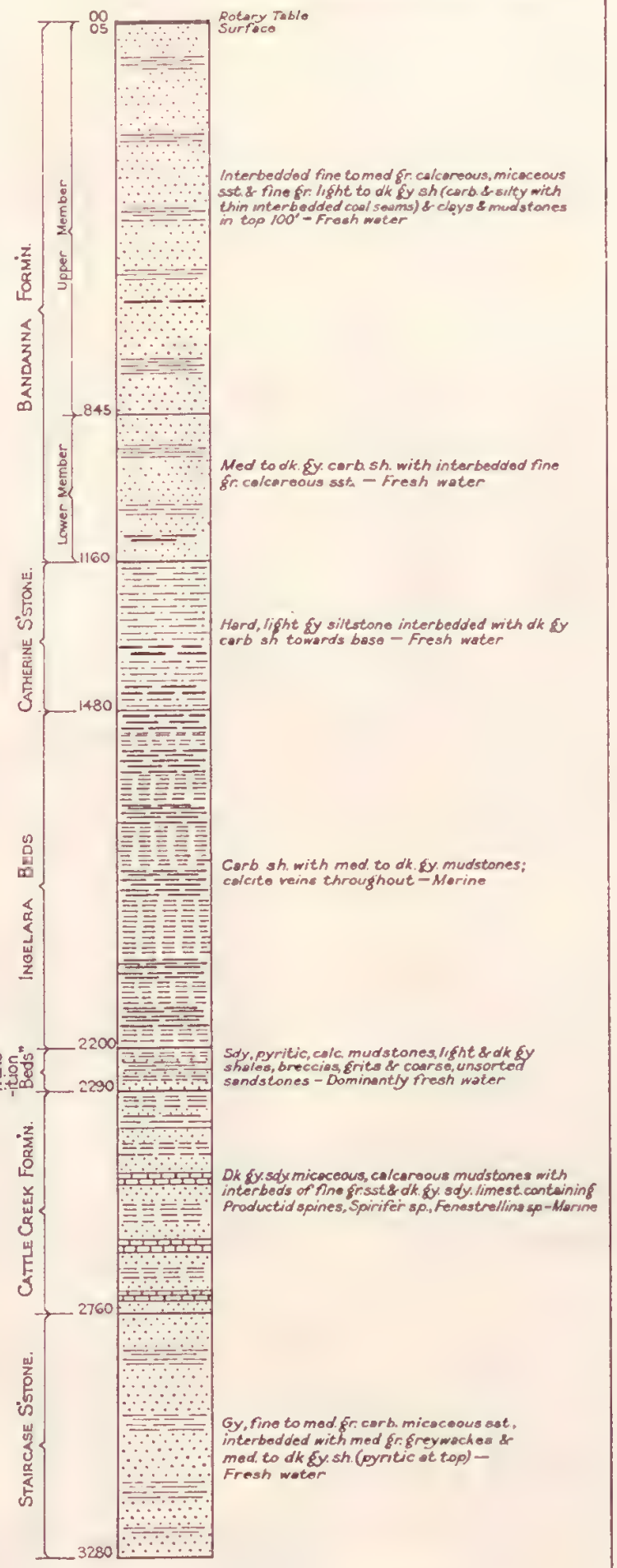
FIG. 6

STRATIGRAPHIC LOG

A.A.O. No.7 (ARCADIA)

Location: Lat. 25°17'53"S.; Long. 148°47'43"E.
Drilled by Associated Austn. Oilfields N.L.
Drill: Sullivan 300A: Drilling Period: 8.4.57 to 14.7.57
Rotary Table Elevn. 1227' Ht. of Rotary Table: 5'

SCALE OF FEET 200 0 200 400


00
05
845
1160
1480
2200
2290
2760
3280
BANDANNA FORMN.
Upper Member
Lower Member
CATHERINE S'STONE.
INGELARA BEDS
"Trans-ition Beds"
CATTLE CREEK FORMN.
STAIRCASE S'STONE.
Rotary Table Surface
Interbedded fine to med gr. calcareous, micaceous sst. & fine gr. light to dk gy sh (carb. & silty with thin interbedded coal seams) & clays & mudstones in top 100' – Fresh water
Med to dk. gy. carb. sh. with interbedded fine gr. calcareous sst. – Fresh water
Hard, light gy siltstone interbedded with dk gy carb sh towards base – Fresh water
Carb. sh. with med. to dk. gy. mudstones; calcite veins throughout – Marine
Sdy., pyritic, calc. mudstones, light & dk gy shales, breccias, grits & coarse, unsorted sandstones – Dominantly fresh water
Dk gy. sdy. micaceous, calcareous mudstones with interbeds of fine gr. sst. & dk. gy. sdy. limest. containing Productid spines, Spirifer sp., Fenestrellina sp – Marine
Gy, fine to med. gr. carb. micaceous sst., interbedded with med gr. greywackes & med. to dk gy. sh. (pyritic at top) – Fresh water

Stratigraphy by S.S. Derrington

FIGURE 7

STRATIGRAPHIC LOGS

VERTICAL SCALE OF FEET

200 100 0 200 400 600 800 1000

A.A.O. Nº 8 (KARUMBA)

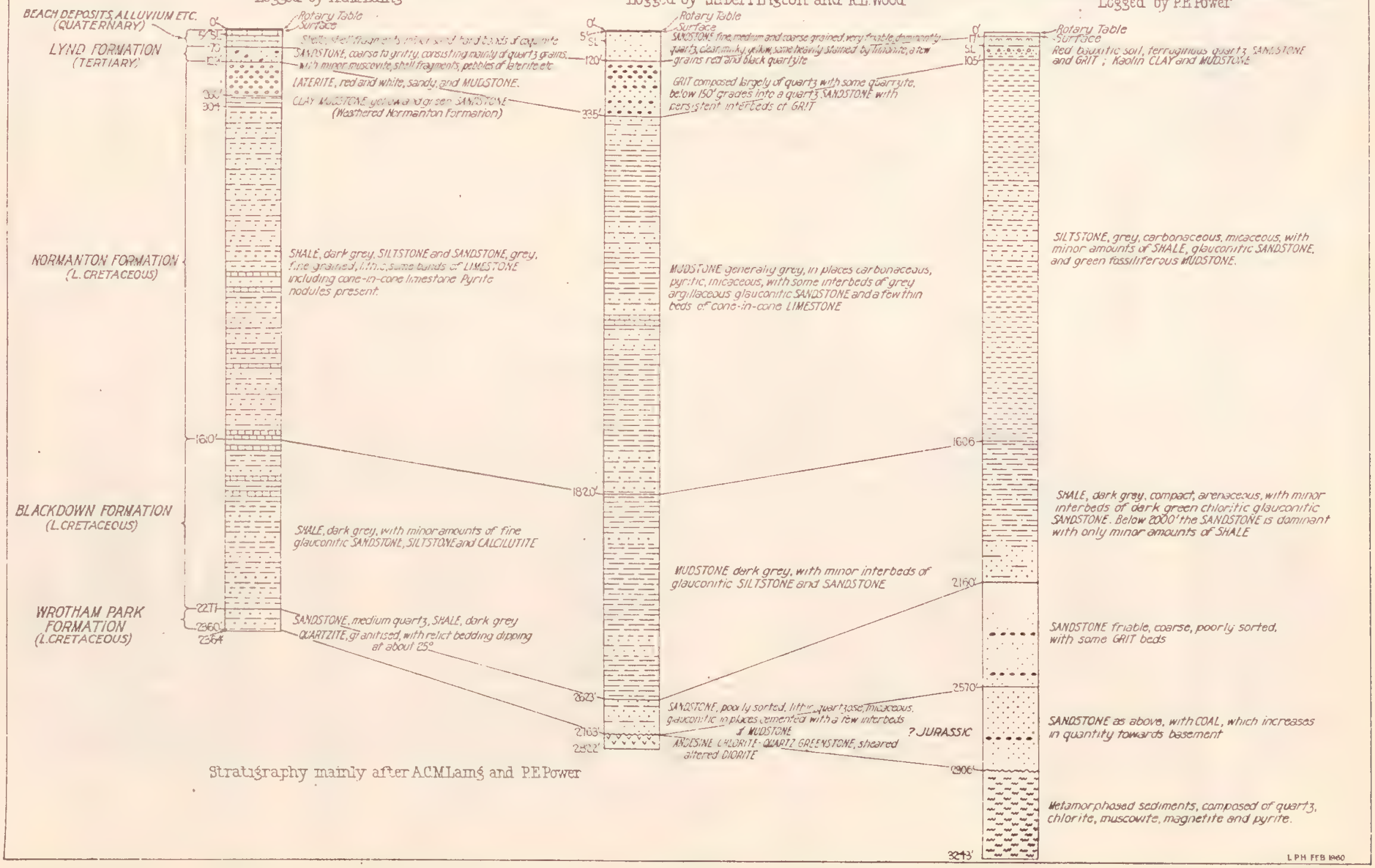
Location Lat 17°24'36·4"S Long 140°52'21·6"E
Drilled by Mines Administration Pty Ltd
Drill Sullivan 300A Period 6-2-58 to 3-3-58
Rotary Table Elevation 201ft Height of Rotary Table 5ft
Logged by A.C.M.Laing

F.B.H. Nº1 (WYAABA)

Location Lat 16°29'30"S Long 141°37'22"E
Drilled by Mines Administration Pty. Ltd.
Drill Sullivan 300A Period 28-10-57 to 15-11-57
Rotary Table Elevation 405ft Height of Rotary Table 5ft
Logged by S.S.Derrington and R.L.Wood

Z.C.L. Nº1 (WEIPA)

Location Lat 12°43'00"S Long 141°55'30"E
Drilled by Oil Drilling and Exploration Ltd
Drill National 55 Period 20-8-57 to 12-10-57
Rotary Table Elevation 507ft. Height of Rotary Table 17ft
Logged by P.E.Power


BEACH DEPOSITS, ALLUVIUM ETC. (QUATERNARY)
LYND FORMATION (TERTIARY)
NORMANTON FORMATION (L. CRETACEOUS)
BLACKDOWN FORMATION (L.CRETACEOUS)
WROTHAM PARK FORMATION (L.CRETACEOUS)
Rotary Table
Surface
Shells, shell fragments and indurated bands of calcrete
SANDSTONE, coarse to gritty, consisting mainly of quartz grains with minor muscovite, shell fragments, pebbles of laterite etc
LATERITE, red and white, sandy, and MUDSTONE.
CLAY MUDSTONE yellow and green SANDSTONE (Weathered Normanton Formation)
SHALE, dark grey, SILTSTONE and SANDSTONE, grey, fine grained, lithic, some bands of LIMESTONE including cone-in-cone limestone Pyrite nodules present.
SHALE, dark grey, with minor amounts of fine glauconitic SANDSTONE, SILTSTONE and CALCILUTITE
SANDSTONE, medium quartz, SHALE, dark grey QUARTZITE, granitised, with relict bedding dipping at about 25°
SANDSTONE fine, medium and coarse grained, very friable, dominantly quartz, clear, milky, yellow, some heavily stained by limonite, a few grains red and black quartzite
GRIT composed largely of quartz with some quartzite, below 150' grades into a quartz SANDSTONE with persistent interbeds of GRIT
MUDSTONE generally grey, in places carbonaceous, pyritic, micaceous, with some interbeds of grey argillaceous glauconitic SANDSTONE and a few thin beds of cone-in-cone LIMESTONE
MUDSTONE dark grey, with minor interbeds of glauconitic SILTSTONE and SANDSTONE
SANDSTONE, poorly sorted, lithic quartzose, micaceous, glauconitic in places cemented with a few interbeds of MUDSTONE
? JURASSIC
ANDESINE CHLORITE-QUARTZ GREENSTONE, sheared altered DIORITE
Red bauxitic soil, ferruginous quartz SANDSTONE and GRIT ; Kaolin CLAY and MUDSTONE
SILTSTONE, grey, carbonaceous, micaceous, with minor amounts of SHALE, glauconitic SANDSTONE, and green fossiliferous MUDSTONE.
SHALE, dark grey, compact, arenaceous, with minor interbeds of dark green chloritic glauconitic SANDSTONE. Below 2000' the SANDSTONE is dominant with only minor amounts of SHALE
SANDSTONE friable, coarse, poorly sorted, with some GRIT beds
SANDSTONE as above, with COAL, which increases in quantity towards basement
Metamorphosed sediments, composed of quartz, chlorite, muscovite, magnetite and pyrite.
0'
5'
SL
75'
120'
300'
304'
335'
1610'
1820'
2271'
2360'
2364'
2623'
2163'
2822'
17'
105'
1606'
2160'
2570'
2906'
3243'

Stratigraphy mainly after A.C.M.Laing and P.E.Power

L.P.H. FEB 1960

FIG. 8

STRATIGRAPHIC LOGS

A.O.E. No.1 (REID'S DOME)

Location: 29 m. S.W. from Rolleston. LAT. 24°47'25" S. LONG. 148°19'18" E.
Drilled by Santa Fe Drilling Co.
Drill: National 50 Drilling period 30-8-54-20-4-55
Rotary Table Elev^{n} 980' Height of Rotary Table 10'

A.O.E. No.2 (REID'S DOME)

Location: Lat. 24°51' S. Long. 148°19' E.
Drilled by Santa Fe Drilling Co.
Drill. National 50 Drilling period 2-6-55-13-7-55
Rotary Table Elev^{n} 1219'. Height of Rotary Table 12'

A.O.E No.3 (CONSUELO)

Location: Lat. 24°33'40" S. Long 148°23'20" E.
Drilled by Santa Fe Drilling Co.
Drill: National 50 Drilling period 1-9-55-1-11-55
Rotary Table Elev^{n} 1000' Height of Rotary Table 12'

SCALE OF FEET 1000 500 0 1000 2000

J.A.W. 25-7-56

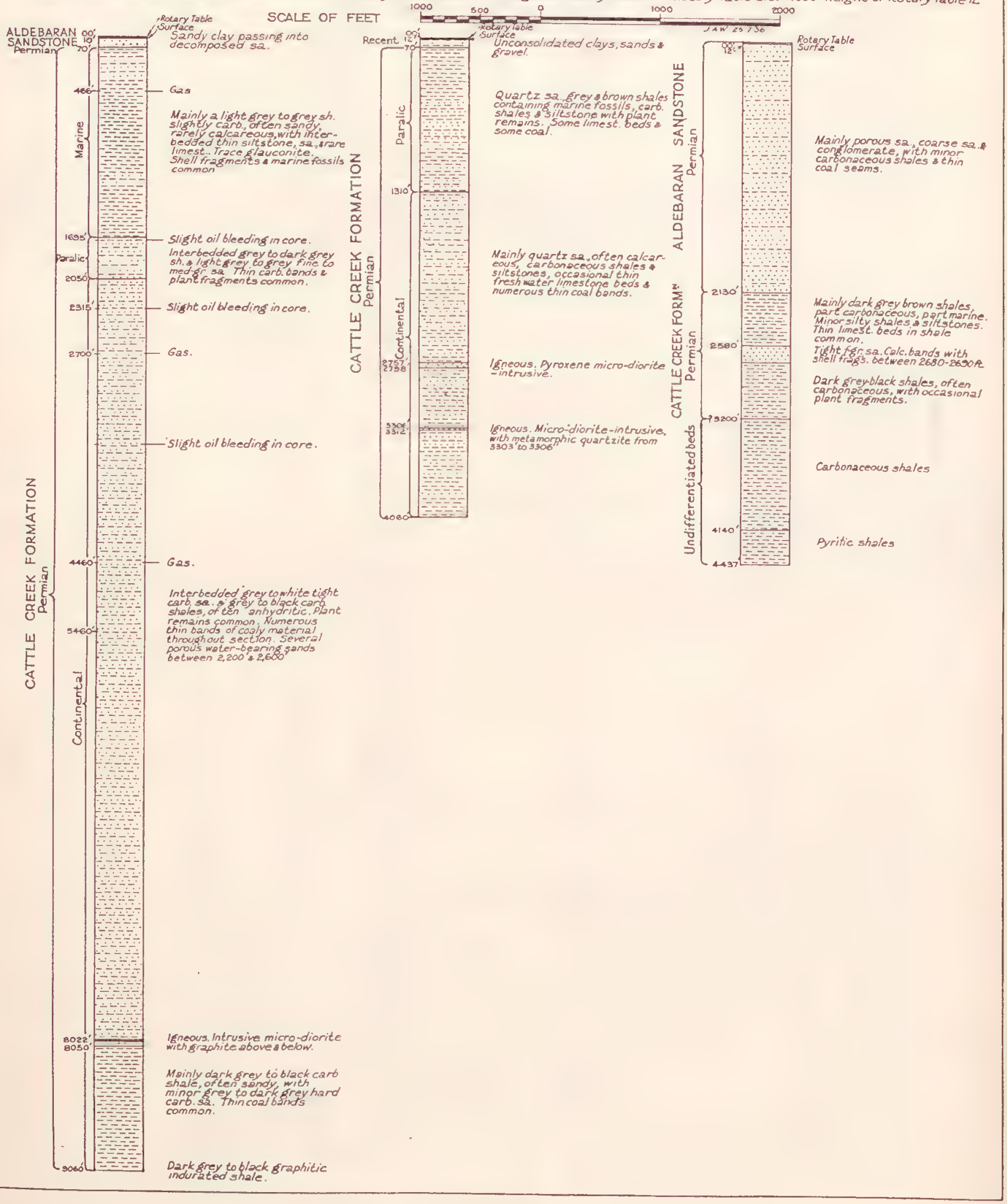

ALDEBARAN SANDSTONE Permian
Rotary Table Surface
00'
10'
70'
466'
Gas
Marine
Mainly a light grey to grey sh. slightly carb., often sandy, rarely calcareous, with inter-bedded thin siltstone, sa., & rare limest.. Trace glauconite. Shell fragments & marine fossils common
1695'
Slight oil bleeding in core.
Paralic
Interbedded grey to dark grey sh. & light grey to grey fine to med-gr. sa. Thin carb. bands & plant fragments common.
2050'
2315'
Slight oil bleeding in core.
2700'
Gas.
Slight oil bleeding in core.
CATTLE CREEK FORMATION Permian
4460'
Gas.
Continental
Interbedded grey to white tight carb. sa. & grey to black carb. shales, often anhydritic. Plant remains common. Numerous thin bands of coaly material throughout section. Several porous water-bearing sands between 2,200 & 2,600'
5460'
8022'
8050'
Igneous. Intrusive micro-diorite with graphite above & below.
Mainly dark grey to black carb shale, often sandy, with minor grey to dark grey hard carb. sa. Thin coal bands common.
9060'
Dark grey to black graphitic indurated shale.
Recent 12'
Rotary Table Surface
70'
Unconsolidated clays, sands & gravel.
Paralic
Quartz sa., grey & brown shales containing marine fossils, carb. shales & siltstone with plant remains. Some limest. beds & some coal.
1310'
CATTLE CREEK FORMATION Permian
Continental
Mainly quartz sa., often calcareous, carbonaceous shales & siltstones, occasional thin fresh water limestone beds & numerous thin coal bands.
2757'
2798'
Igneous. Pyroxene micro-diorite - intrusive.
3304'
3312'
Igneous. Micro-diorite-intrusive, with metamorphic quartzite from 3303' to 3306'
4080'
ALDEBARAN SANDSTONE Permian
Rotary Table Surface
00'
12'
Mainly porous sa., coarse sa. & conglomerate, with minor carbonaceous shales & thin coal seams.
2130'
CATTLE CREEK FORM^{n} Permian
Mainly dark grey brown shales, part carbonaceous, part marine. Minor silty shales & siltstones. Thin limest. beds in shale common.
2580'
Tight f.gr. sa. Calc. bands with shell frags. between 2680-2690 ft.
Undifferentiated beds
Dark grey-black shales, often carbonaceous, with occasional plant fragments.
3200'
Carbonaceous shales
4140'
Pyritic shales
4437'

FIGURE 9

STRATIGRAPHIC LOG
A.O.G. No.2 (MIRRI MIRRI)

(I.W.S.C. Reg. No. 13683)

Location: Lat. 27°31'S., Long. 149°55'E.; 13 mls. 173° from Meandarra
Drill: Hydromaster 1500 Driller: L. E. Maller
Period: Reached 3000 ft. 20-11-58; Completed 25-5-59
Surface Elevation 998 ft.
Logged by driller 0-4645 ft. Logged geologically 2950-4645 ft.
Stratigraphy by Dr. T.B.H. Jenkins
Vertical Scale of Feet.

200 100 0 200 400 600 800

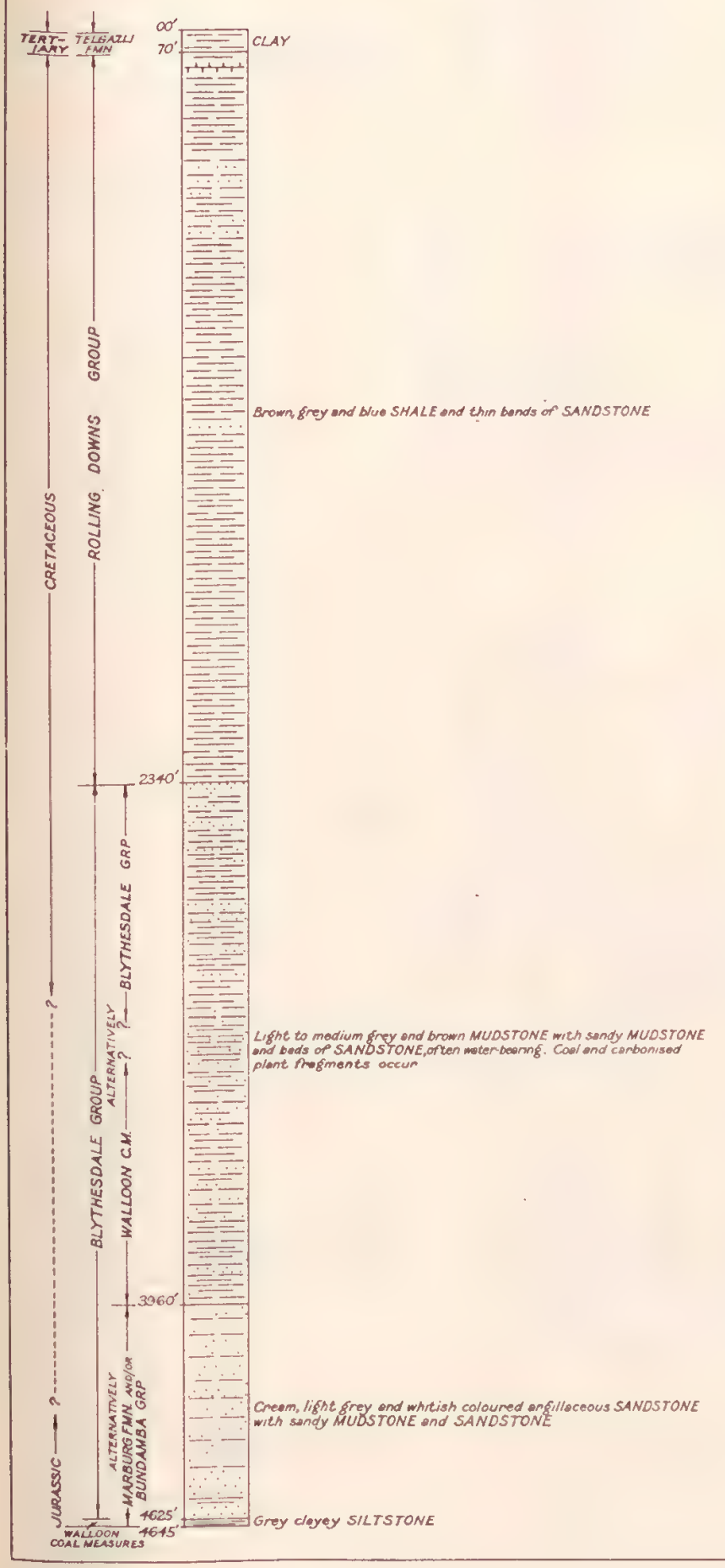


FIGURE 10

STRATIGRAPHIC LOG
H.B.R. No 1 (WRECK ISLAND)

Location: Lat. 23°20'S. Long 151°57'30"E
Drilled by Mines Administration Pty. Ltd.
Drill: National T32 Period 7-5-59 to 14-6-59
RTE: 22ft Surface Elevation 13ft.
Well-logging and stratigraphy by S.S. Derrington B.Sc.
Vertical Scale of Feet.

100 50 0 100 200 300 400

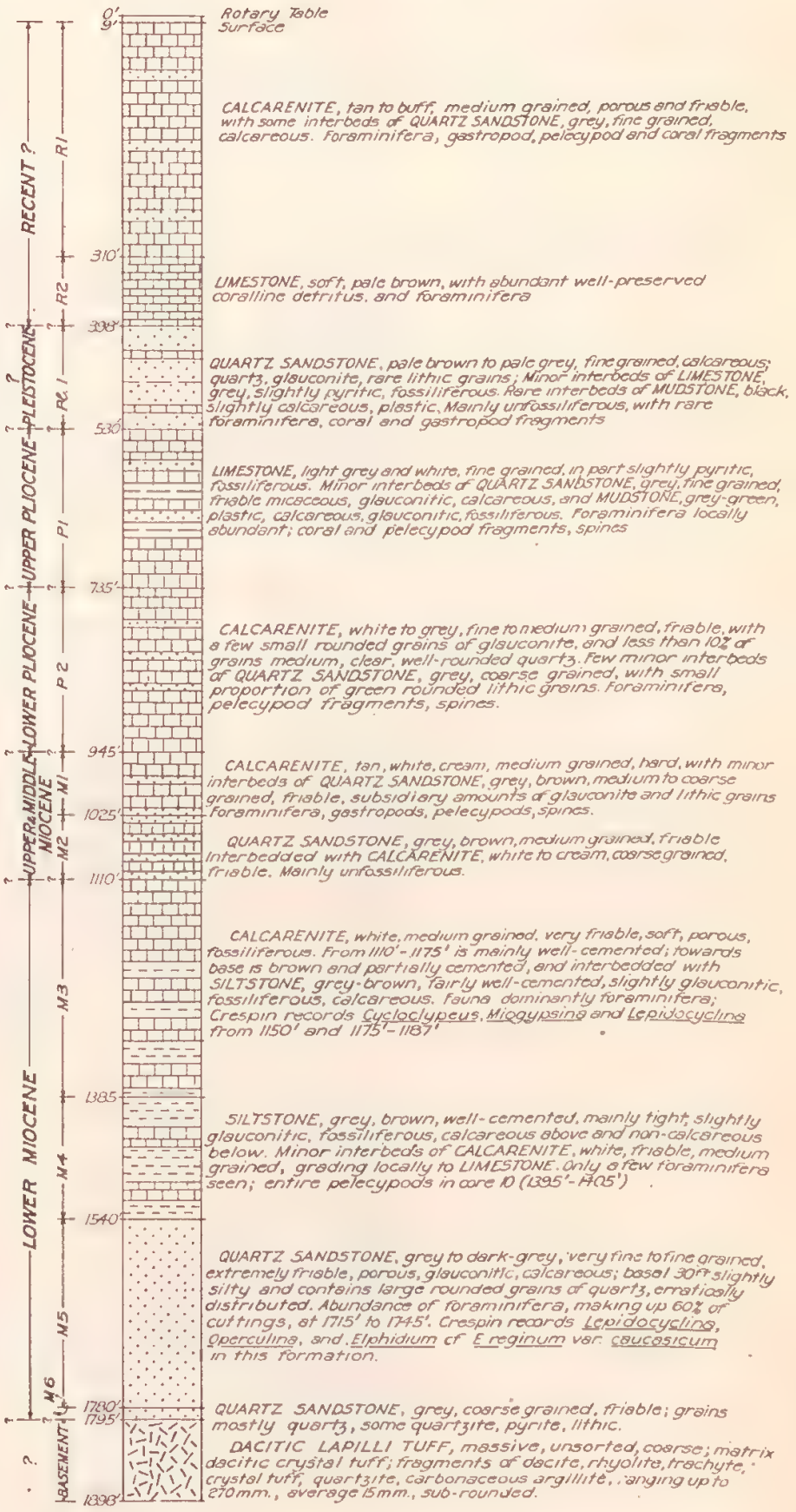

RECENT ?
PLEISTOCENE ?
UPPER PLIOCENE ?
LOWER PLIOCENE ?
UPPER & MIDDLE MIOCENE ?
LOWER MIOCENE ?
BASEMENT ?
R1
R2
P1
P2
M1
M2
M3
M4
M5
M6
0'
9'
Rotary Table
Surface
CALCARENITE, tan to buff, medium grained, porous and friable, with some interbeds of QUARTZ SANDSTONE, grey, fine grained, calcareous. Foraminifera, gastropod, pelecypod and coral fragments
310'
LIMESTONE, soft, pale brown, with abundant well-preserved coralline detritus, and foraminifera
398'
QUARTZ SANDSTONE, pale brown to pale grey, fine grained, calcareous; quartz, glauconite, rare lithic grains; Minor interbeds of LIMESTONE, grey, slightly pyritic, fossiliferous. Rare interbeds of MUDSTONE, black, slightly calcareous, plastic. Mainly unfossiliferous, with rare foraminifera, coral and gastropod fragments
530'
LIMESTONE, light grey and white, fine grained, in part slightly pyritic, fossiliferous. Minor interbeds of QUARTZ SANDSTONE, grey, fine grained, friable micaceous, glauconitic, calcareous, and MUDSTONE, grey-green, plastic, calcareous, glauconitic, fossiliferous. Foraminifera locally abundant; coral and pelecypod fragments, spines
735'
CALCARENITE, white to grey, fine to medium grained, friable, with a few small rounded grains of glauconite, and less than 10% of grains medium, clear, well-rounded quartz. Few minor interbeds of QUARTZ SANDSTONE, grey, coarse grained, with small proportion of green rounded lithic grains. Foraminifera, pelecypod fragments, spines.
945'
CALCARENITE, tan, white, cream, medium grained, hard, with minor interbeds of QUARTZ SANDSTONE, grey, brown, medium to coarse grained, friable, subsidiary amounts of glauconite and lithic grains. Foraminifera, gastropods, pelecypods, spines.
1025'
QUARTZ SANDSTONE, grey, brown, medium grained, friable interbedded with CALCARENITE, white to cream, coarse grained, friable. Mainly unfossiliferous.
1110'
CALCARENITE, white, medium grained, very friable, soft, porous, fossiliferous. From 1110'-1175' is mainly well-cemented; towards base is brown and partially cemented, and interbedded with SILTSTONE, grey-brown, fairly well-cemented, slightly glauconitic, fossiliferous, calcareous. Fauna dominantly foraminifera; Crespin records Cycloclypeus, Miogypsina and Lepidocyclina from 1150' and 1175'-1187'
1385
SILTSTONE, grey, brown, well-cemented, mainly tight, slightly glauconitic, fossiliferous, calcareous above and non-calcareous below. Minor interbeds of CALCARENITE, white, friable, medium grained, grading locally to LIMESTONE. Only a few foraminifera seen; entire pelecypods in core 10 (1395'-1405')
1540'
QUARTZ SANDSTONE, grey to dark-grey, very fine to fine grained, extremely friable, porous, glauconitic, calcareous; basal 30ft slightly silty and contains large rounded grains of quartz, erratically distributed. Abundance of foraminifera, making up 60% of cuttings, at 1715' to 1745'. Crespin records Lepidocyclina, Operculina, and Elphidium cf E reginum var. caucasicum in this formation.
1780'
1795'
QUARTZ SANDSTONE, grey, coarse grained, friable; grains mostly quartz, some quartzite, pyrite, lithic.
DACITIC LAPILLI TUFF, massive, unsorted, coarse; matrix dacitic crystal tuff; fragments of dacite, rhyolite, trachyte, crystal tuff, quartzite, carbonaceous argillite, ranging up to 270mm., average 15mm., sub-rounded.
1898'

FIG. 11

STRATIGRAPHIC LOGS

L.O.L. No.1 (CLEEVE)

Location: Cleeve - 8¾ miles E from Longreach
Drilled by Oil Drilling & Exploration Ltd.
Drill: National T-32: Drilling Period: 17.12.54 to 13.1.55
Rotary Table Elevn 712' Ht. of Rotary Table. 12'

L.O.L. No.2 (LONGREACH)

Location: Tn of Longreach 6.2' W & 85' N from S.E. cnr of R 47
Drilled by Oil Drilling & Exploration Ltd'
Drill National T-32: Drilling Period: 25.1.55 to 28.2.55
Rotary Table Elevn 639' Ht. of Rotary Table: 11'

L.O.L. No.3 (LONGREACH)

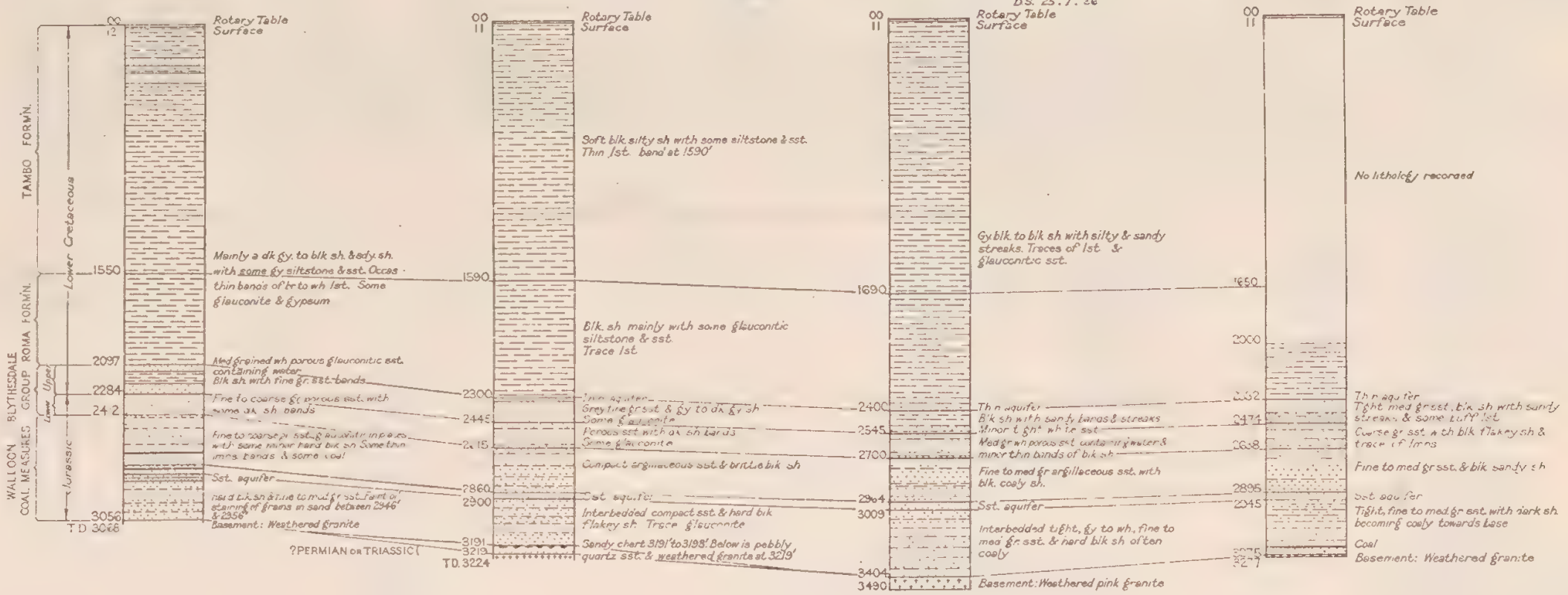
Location: Tn of Longreach 22.5' W & 40' S from N.E. cnr of R 49
Drilled by Oil Drilling & Exploration Ltd.
Drill: National T 20: Drilling Period 15.3.55 to 13.4.55
Rotary Table Elevn 623' Ht of Rotary Table: 11'

L.O.L. No.4 (LONGREACH)

Location: Tn of Longreach 1200' 35.3' (True) from L.O.L. No 2
Drilled by Oil Drilling & Exploration Ltd
Drill: National T-20: Drilling Period 22.4.55 to 19.5.55
Rotary Table Elevn 630' Ht of Rotary Table. 11'

SCALE OF FEET 800 400 0 800 1600

D.S. 25.7.56


Rotary Table Surface
TAMBO FORM'N.
Lower Cretaceous
WALLOON COAL MEASURES
BLYTHESDALE GROUP
ROMA FORM'N.
Upper
Lower
Jurassic
1550
2097
2284
2422
3056
TD 3066
Mainly a dk gy. to blk sh. & dy. sh. with some gy siltstone & sst. Occas thin bands of br to wh lst. Some glauconite & gypsum
Med grained wh porous glauconitic sst. containing water
Blk sh with fine gr. sst. bands
Fine to coarse gl porous sst. with some dk sh bands
Fine to coarse gl sst. & dk shale interbeds with some rather hard blk sh. Sometimes bands & some coal
Sst. aquifer
Med blk sh & fine to med gr sst. Faint oil staining of grains in sand between 2946' & 2956'
Basement: Weathered Granite
1590
2300
2445
2715
2860
2900
3191
3219
TD 3224
?PERMIAN OR TRIASSIC
Soft blk. silty sh with some siltstone & sst. Thin lst. band at 1590'
Blk. sh mainly with some glauconitic siltstone & sst. Trace lst
Thin aquifer
Grey fine gr sst & gy to dk gy sh
Some glauconite
Porous sst with dk sh bands
Some glauconite
Compact argillaceous sst & brittle blk sh
Sst. aquifer
Interbedded compact sst & hard blk flakey sh Trace glauconite
Sandy chert 3191' to 3198'. Below is pebbly quartz sst & weathered granite at 3219'
1690
2400
2545
2700
2904
3009
3404
3490
Gy blk to blk sh with silty & sandy streaks. Traces of lst & glauconitic sst.
Thin aquifer
Blk sh with sandy bands & streaks
Minor tight white sst
Med gr wh porous sst with gas & water & minor thin bands of blk sh
Fine to med gr argillaceous sst with blk. coaly sh.
Sst. aquifer
Interbedded tight, gy to wh, fine to med gr sst. & hard blk sh often coaly
Basement: Weathered pink granite
1650
2000
2352
2474
2638
2895
2945
3075
3277
No lithological record
Thin aquifer
Tight med gr sst, blk sh with sandy streaks & some tuff lst
Coarse gr sst with blk flakey sh & trace of lmns
Fine to med gr sst. & blk sandy sh
Sst. aquifer
Tight, fine to med gr sst with dark sh becoming coaly towards base
Coal
Basement: Weathered granite

Stratigraphy by W.D. Mott

FIG. 12
STRATIGRAPHIC LOGS

L.S.D. No.1 (CHERWELL)

Location: Lat. 25°14'43"S. & Long 152°28'36" E.
Drilled by Oil Drilling and Exploration Ltd.
Drill: National 80B. Drilling period 8.11.54 – 6.3.55
Rotary Table Elevn 73'. Height of Rotary Table 17'

L.S.D. No. 2 (SUSAN RIVER)

Loc: 349°23' 713 links from E. corner Por. 2v. Par. Urangan.
Drilled by Oil Drilling and Exploration Ltd.
Drill: National 80B. Drilling period 9.4.55 - 9.8.55
Rotary Table Elevn 66'. Height of Rotary Table 17'

SCALE OF FEET 800 0 800 1600

J.A.W. 25.7.58

ELLIOTT FORMN

BURRUM COAL MEASURES U. Cretaceous

MARYBOROUGH FORMATION L. Cretaceous

GRAHAMS CREEK VOLCANICS L. Cretaceous

00'	Rotary Table	
55'	Surface	Hard coarse felspathic sa. with minor red & grey clayey shales.
1035'		Grey, white & green f-g calc. sa. mainly with grey to black sandy shale & some argillaceous limestones. Thin beds of black bituminous coal above 1035'.
1325'		Grey sandy shale, grey to black carb. shale & siltstone.
1490'		Light to dark grey shale, minor sandy shale, with traces of limestone & pyrites
2490'		Mainly glauconitic calc. sa with some grey sh. & shaly sa..
2560'		Grey to dark grey shale
3703'		F-g glauconitic sa. – water bearing.
3840'		Grey sh.
5486'		Fine-gr. calc. sa. with some sandy shale & glauconite.
6000'		Interbedded shale & sandy sh. with minor sa. Trace of glauconite & thin limestone near base. Trace of calcite throughout.
7570'		Grey sandy shale mainly with traces of calcite, glauconite & siltstone. Plant remains at 7920 feet.
8345'		Tuffaceous sa. & conglomerates, tuffs, volcanic ashes and shales with a few thin coal beds near base.
8773'		

00'	Rotary Table	
17'	Surface	Grey to dark grey siltstone and shale
4160'		Mainly dark grey silty shales, shales & siltstones, with thin beds of brown limestone & lesser sandstone. Calcite veining pronounced & glauconite in upper 2300'
4310'		Black carbonaceous shale. Traces of calcite pyrite & tuffaceous sandstone.
8069'		Mainly medium-grained white to grey tuffaceous sa., often pebbly, with some black carb. shales. Some volcanic agglomerate. Trace of calcite veins & pyrites throughout.

Stratigraphy by C.W. Siller

FIG. 13
STRATIGRAPHIC LOG
S.P.L. No.1 (BIRKHEAD)

Location: Lat. 24°36'54"S; Long 146°23'27"E.
Drilled by Oil Drilling & Exploration Ltd.
Drill: National 80B: Drilling Period: 28.4.57 to 20.6.57
Rotary Table Elevn. 1570' Ht. of Rotary Table: 14'

SCALE OF FEET 800 400 0 800

D.S. 16.1.58

MARBURG SANDSTONE & BUNDAMBA GROUP — Triassic – Jurassic

CHESHIRE FORMN. — Permo-Carboniferous

COLINLEA FORMN. — Permo-Carboniferous

JOE JOE FORMN. — Permo-Carboniferous

00'	Rotary Table	
14'	Surface	
1250'		Gy, fine gr. sst.; loose to well consol. & with occasional bands of dk. gy. silty sh. & lignite
1480'		Green, non-calc. & gy. silty clay & sh.
2260'		Fine to med. gr. gy. sst. Conglom. at base
2990'		Sst. Unconsol qtz. conglom.
3000'		Med. to fine gr. sst. with interbedded siltstone
4460'		Carb. sh.
5185'6"		Pebble to boulder size conglom.
		Sst. with interbedded siltstone & sh.
		Hard dk. gy. sh. with laminae of gy. siltstone

Stratigraphy by E.A. Webb

FIGURE 14

S.Q.D. Nº1 (MORELLA)

Location: Lat. 25° 00' 46" S. Long 148° 29' 04" E
Drilled by Shell (Queensland) Development Pty. Ltd.
Drill : Ideal 100 Period 30·4·50 to 21·1·51
Rotary Table elevation 965 ft. Height of Rotary Table 15 ft.

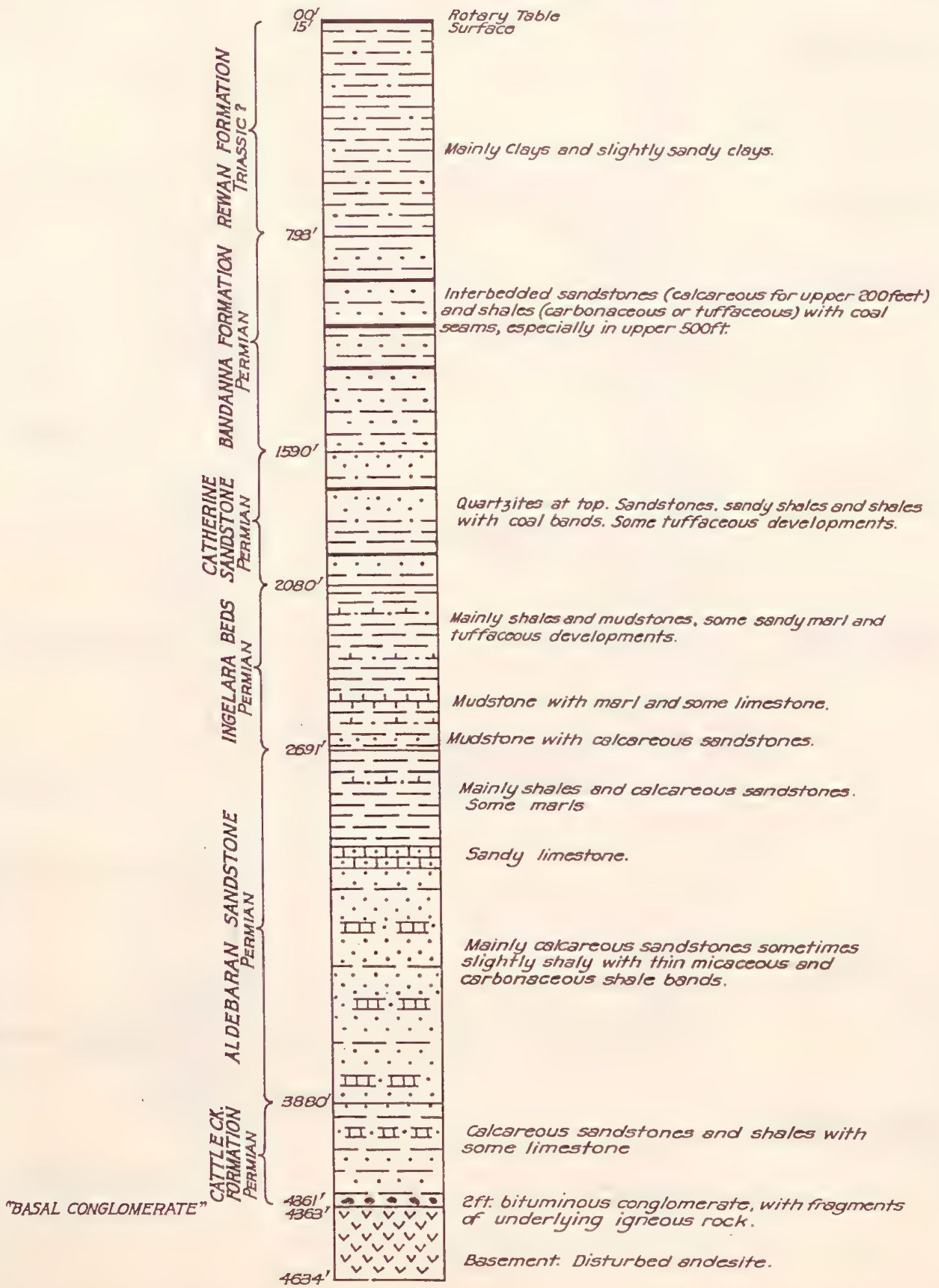


FIG. 15

STRATIGRAPHIC LOGS

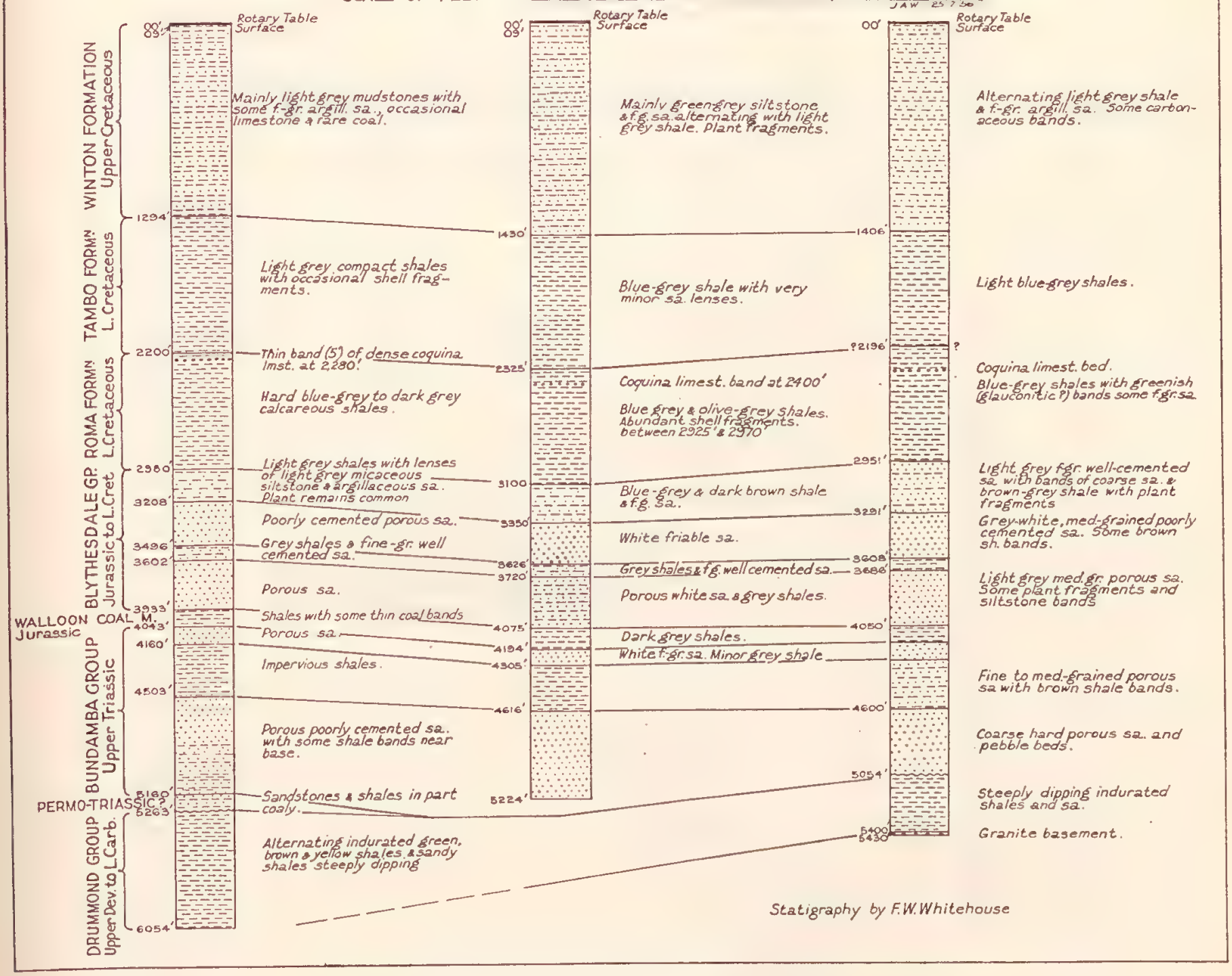
W.O.L. No.3 (WARBRECCAN)
Location: 22° W of N. 3·3 miles from W.O.L 2
Drilled by Petroleum Drilling Corp.
Drill National T.32. Period: 23·6·55 to 28·8·55
Rotary Table elevn 673'. Ht. of Rotary Table 9'

W.O.L. No.2 (WARBRECCAN)
Location: 33° E of N. 477 chains from Warbreccan L Bore
Drilled by Petroleum Drilling Corp.
Drill: National T.32. Period 3·4·55 to 9·6·55
Rotary Table elevn 782'. Ht. of Rotary Table 9.

W.O.L. No.1 (WARBRECCAN)
Location: 201°31'13m 17·6 chns from Intersection point, Parishes of Beatrice, Senex & Thomas.
Drilled by Petroleum Drilling Corp.
Drill: National T.32. Period: 28·1·55 to 23·3·55
Rotary Table elevn 770'. Ht. of Rotary Table 9'

SCALE OF FEET 1000 500 0 1000 2000

JAW 25 7 56


Rotary Table Surface
89'
00'
WINTON FORMATION Upper Cretaceous
TAMBO FORMn L. Cretaceous
ROMA FORMn L. Cretaceous
BLYTHESDALE GP. Jurassic to L. Cret
WALLOON COAL M. Jurassic
BUNDAMBA GROUP Upper Triassic
PERMO-TRIASSIC?
DRUMMOND GROUP Upper Dev. to L. Carb.
1294'
1430'
1406'
2200'
2325'
?2196'
?
2980'
3100'
2951'
3208'
3350'
3291'
3496'
3602'
3626'
3720'
3608'
3686'
3933'
4043'
4075'
4050'
4160'
4194'
4305'
4503'
4616'
4600'
5180'
5224'
5054'
5263'
5400'
6054'
Mainly light grey mudstones with some f-gr. argill. sa., occasional limestone & rare coal.
Mainly green-grey siltstone & f.g. sa. alternating with light grey shale. Plant fragments.
Alternating light grey shale & f-gr. argill. sa. Some carbonaceous bands.
Light grey compact shales with occasional shell fragments.
Blue-grey shale with very minor sa. lenses.
Light blue-grey shales.
Thin band (5') of dense coquina lmst. at 2,280'.
Coquina limest. band at 2400'
Coquina limest. bed.
Hard blue-grey to dark grey calcareous shales.
Blue grey & olive-grey shales. Abundant shell fragments. between 2925' & 2970'
Blue-grey shales with greenish (glauconitic?) bands some f gr. sa.
Light grey shales with lenses of light grey micaceous siltstone & argillaceous sa. Plant remains common
Blue-grey & dark brown shale & f.g. Sa.
Light grey f-gr. well-cemented sa. with bands of coarse sa. & brown-grey shale with plant fragments
Poorly cemented porous sa.
White friable sa.
Grey-white, med-grained poorly cemented sa. Some brown sh. bands.
Grey shales & fine-gr. well cemented sa.
Grey shales & f.g. well cemented sa.
Porous sa.
Porous white sa. & grey shales.
Light grey med. gr. porous sa. Some plant fragments and siltstone bands
Shales with some thin coal bands
Porous sa.
Dark grey shales.
Impervious shales.
White f-gr. sa. Minor grey shale
Fine to med.-grained porous sa with brown shale bands.
Porous poorly cemented sa. with some shale bands near base.
Coarse hard porous sa. and pebble beds.
Sandstones & shales in part coaly.
Steeply dipping indurated shales and sa.
Alternating indurated green, brown & yellow shales & sandy shales steeply dipping
Granite basement.

Statigraphy by F.W. Whitehouse

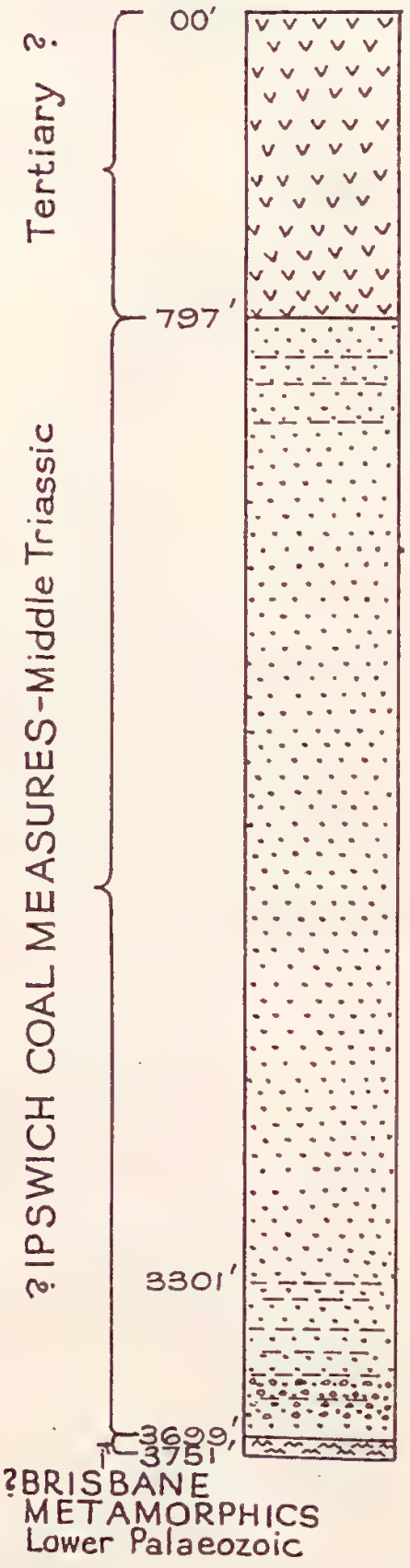
FIG. 16

STRATIGRAPHIC LOG
W.P.L. No.1 (WELLINGTON POINT)

Location : Wellington Point
Drilled by Oil Drilling and Exploration Ltd.
Drill: National T20. Drilling period 10-7-'55-8-9-'55
Rotary Table Elev^{n} 17'. Height of Rotary Table 10'

SCALE OF FEET 400 0 800 1600

J.A.W. 25 . 7 . 56



Basalt & scoriaceous material mainly with some red & green sh.

White to grey fine to medium - grained sa. with thin bands of shale & coaly material & some conglomerate below 3560'.

Basement: White-grey meta - morphosed siliceous argillite with pyrite and quartz veins.

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

First Supplement to

Geological Survey Publication No. 299

"OCCURRENCE OF PETROLEUM AND NATURAL GAS IN QUEENSLAND"

1961

PETROLEUM EXPLORATION IN QUEENSLAND DURING 1960

PETROLEUM PROSPECTING
By I. W. MORLEY, State Mining Engineer

DRILLING
By R. J. ALLEN and I. G. SANKER, Geologists

BRISBANE
By Authority: S. G. REID, Government Printer
1961

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PETROLEUM EXPLORATION IN QUEENSLAND DURING 1960

PREFACE

Publication No. 299 of the Geological Survey of Queensland—"Occurrence of Petroleum and Natural Gas in Queensland"—dealt with the search for petroleum in Queensland to the end of 1959. To keep this publication up to date, it is proposed to issue as a supplement each year, a reprint of the Sections of the Annual Report of the Department of Development and Mines relating to petroleum exploration. This reprint is the first supplement.

PETROLEUM PROSPECTING

By I. W. MORLEY, State Mining Engineer

This section is divided into parts as follows:—

1. Introduction
2. Oil Prospecting Titles Held
3. Prospecting
4. Geophysical Surveys
5. Oil and Natural Gas Drilling
6. Employment and Accidents
7. Legislation and Instruction to Operators
8. General Survey of Industry.

PART 1—INTRODUCTION

As advised in previous years it is intended to make a record of oil prospecting a regular feature of this report. The information given herewith is therefore a continuation of that recorded in the 1959 report.

It will be noted that Part 3, previously known as "Surface Prospecting," is now given the general title of "Prospecting" since it deals with prospecting on each title in turn and in addition discusses the work of Governmental agencies. A new Part 4 "Geophysical Surveys" has been added in which a tabulation and analysis of various statistics relating to such surveys throughout the State is given. It is hoped to extend this type of information in subsequent years. Subsequent parts have been renumbered. It will also be noted that Part 5 "Oil and Natural Gas Drilling" is relatively brief. This is due to the fact technical and geological information obtained from such drilling is now by arrangement, to avoid duplication, dealt with each year in the Geological Survey Report on Drilling for Petroleum, appearing later in this volume and that report should be studied in conjunction with this report.

In connection with Part 6 "Employment and Accidents," with increased activity throughout the State it has been possible to separate employment on surface prospecting work from drilling employment with consequent improvement in statistics. Accident returns are however confined to drilling.

PART 2—OIL PROSPECTING TITLES HELD

In the 1959 Annual Report (pages 74, 75 and 76 and Figure 1) were shown oil prospecting titles held as at December 31st, 1959. Summarised this represented seven Prospecting Petroleum Permits totalling 1,288 square miles and twenty-two Authorities to Prospect totalling in all 823,640 square miles.

Figure 1 shows oil prospecting titles held as at 31st December, 1960. The following Table A sets out their status at that date:—

Table A

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
	Sq. Miles			
		PROSPECTING PETROLEUM PERMITS		
P.P.P. 697	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South-east of Springsure	Suspended
P.P.P. 704	200	Standard Gas Pty. Ltd., L. G. Neill, Managing Director, 307 Queen Street, Brisbane	Brisbane	Drilling
P.P.P. 705	188	Longreach Oil Limited, W. McD. Royle, Managing Director, Box 775, G.P.O., Sydney, W. D. Mott, Consulting Geologist, Astor Court, cnr. Wharf and Leichhardt Streets, Brisbane	Barcaldine and Ilfracombe	Suspended
P.P.P. 706	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South of Springsure ..	Suspended
P.P.P. 707	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South of Springsure ..	Suspended
P.P.P. 708	100	Condamine Oil Ltd., R. Swinton, Managing Director, Box 761K, G.P.O., Brisbane, J. Kooy, Driller in Charge, Auburn Road, Chinchilla	North of Chinchilla ..	Fishing, lost tools
P.P.P. 709	200	W. C. and H. J. Walz, Marian, via Mackay	West of Mackay ..	Suspended
Total ..	1,288	Square Miles.		

Table A—*continued*

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
	Sq. Miles			
		AUTHORITIES TO PROSPECT		
*54P ..	43,000	The Papuan Apinaipi Petroleum Company Limited (B. W. Graham, Chairman and Managing Director) Box 4991, G.P.O., Sydney; D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	Boulia	Geological and Geophysical Investigations
*55P ..	13,100 Amalgamated	Associated Australian Oilfields No Liability: E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	Roma–Theodore	Geological and Geophysical Investigations and Drilling
*56P ..	33,440	Associated Freney Oil Fields No Liability: E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	Mount Morgan–Clermont–Mackay	
57P ..	43,000	Australian Oil and Gas Corporation Limited with whom are associated in this area, Union Oil Development Corporation and Kern County Land Company. A.O.G.: T. W. H. Dee, Managing Director, Box 5048, G.P.O., Sydney; Professor E. A. Rudd, Geological Consultant, University of Adelaide, Adelaide, South Australia. Operator, Union: D. Tower, President, Union Oil Centre, Los Angeles, California, U.S.A.; D. Graves, Resident Manager, Box 5048, G.P.O., Sydney; D. Pyle, Field Superintendent, 203 Margaret Street, Toowoomba	St. George–Miles ..	Geological and Geophysical Investigations and Drilling
58P ..	137,000	Santos Limited (50 per cent.) and Delhi Australian Petroleum Ltd. (50 per cent.). Santos: J. G. Bonython, Chairman, Mutual Life Chambers, 44 Grenfell Street, Adelaide, South Australia; Geo-Surveys of Australia Pty. Ltd. (R. C. Sprigg, Managing Director), Geological Consultants, Box 1479L, G.P.O., Adelaide, South Australia). Delhi: W. Clifford Smith, Vice President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837P, G.P.O., Adelaide, South Australia. Operator, Delhi	Gulf of Carpentaria ..	Suspended, preparing for Drilling
60P ..	15,800	L. H. Smart Oil Exploration Co. Limited: L. H. Smart Chairman, Box 2670, G.P.O., Sydney; R. C. Sprigg, Geological Consultant, Box 1479L, G.P.O., Adelaide, South Australia	Eromanga	Scout Drilling
61P ..	45,900	Plymouth Oil Company; G. H. Fisher, Vice President, Sinton, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cape York Peninsula ..	Suspended
64P ..	37,700	Carpentaria Oils P'ty. Ltd., with whom are associated in this area, Australian Swain Pty. Limited and Cree Oil of Canada (1958) Pty. Limited. Operator, Cree: D. Y. Cooke, Vice President, 708 Seventh Avenue West, Calgary, Alberta, Canada; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Julia Creek, Ilfracombe ..	Suspended
*65P ..	15,500	Associated Australian Oilfields No Liability (50 per cent.) and Associated Freney Oil Fields No Liability (50 per cent.): E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	Normanton	Suspended
66P ..	33,800 Checkerboarded and Interrelated	Santos Limited: J. Bonython, Chairman, Mutual Life Chambers, 44 Grenfell Street, Adelaide, South Australia. Geo-Surveys of Australia Pty. Ltd. (R. C. Sprigg, Managing Director), Geological Consultants, Box 1479L, G.P.O., Adelaide, South Australia	Haddon Corner, Queensland–South Australia Border	Geological and Geophysical Investigations
67P ..	33,800	Delhi Australian Petroleum Ltd. (W. Clifford Smith, Vice President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837P, G.P.O., Adelaide, South Australia) with whom are associated in part of these areas, Frome-Broken Hill Co. Pty. Ltd. (M. A. Osborne, General Manager, Box 384D, G.P.O., Melbourne). Operator, Delhi		
70P ..	10,000	Pacific American Oil Company: Gene Goff, President, 305 Pan American Building, Tulsa 3, Oklahoma, U.S.A., C. W. Siller, Vice President, Box 1555V, G.P.O., Brisbane	Maryborough–Bundaberg	Suspended
71P ..	29,500	Queensland American Oil Company (50 per cent.) and Sunray Mid-Continent Oil Company (25 per cent.) and Phillips Petroleum Company (25 per cent.). Operator, Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 863L, G.P.O., Brisbane	Gympie–Brisbane ..	Suspended

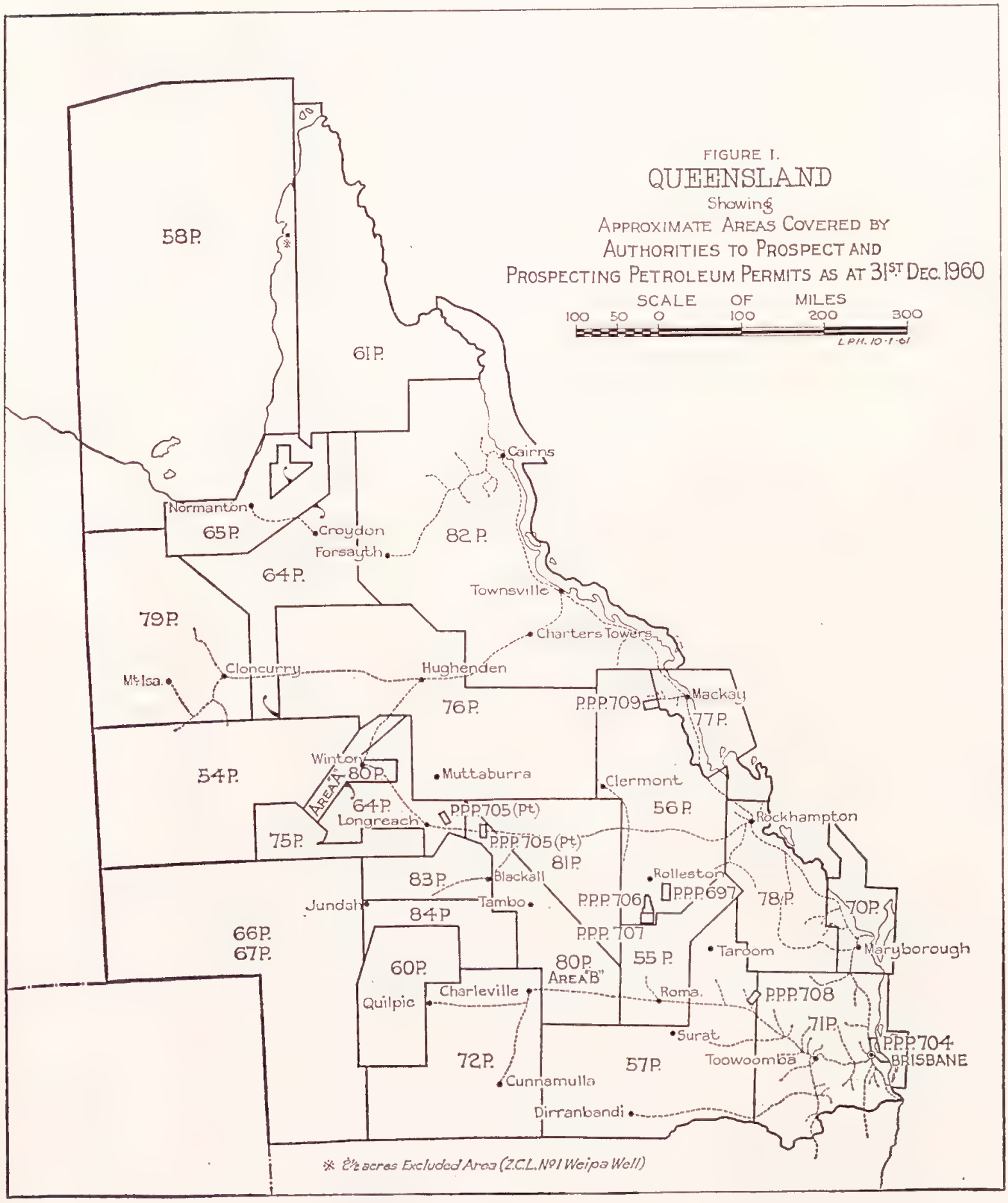
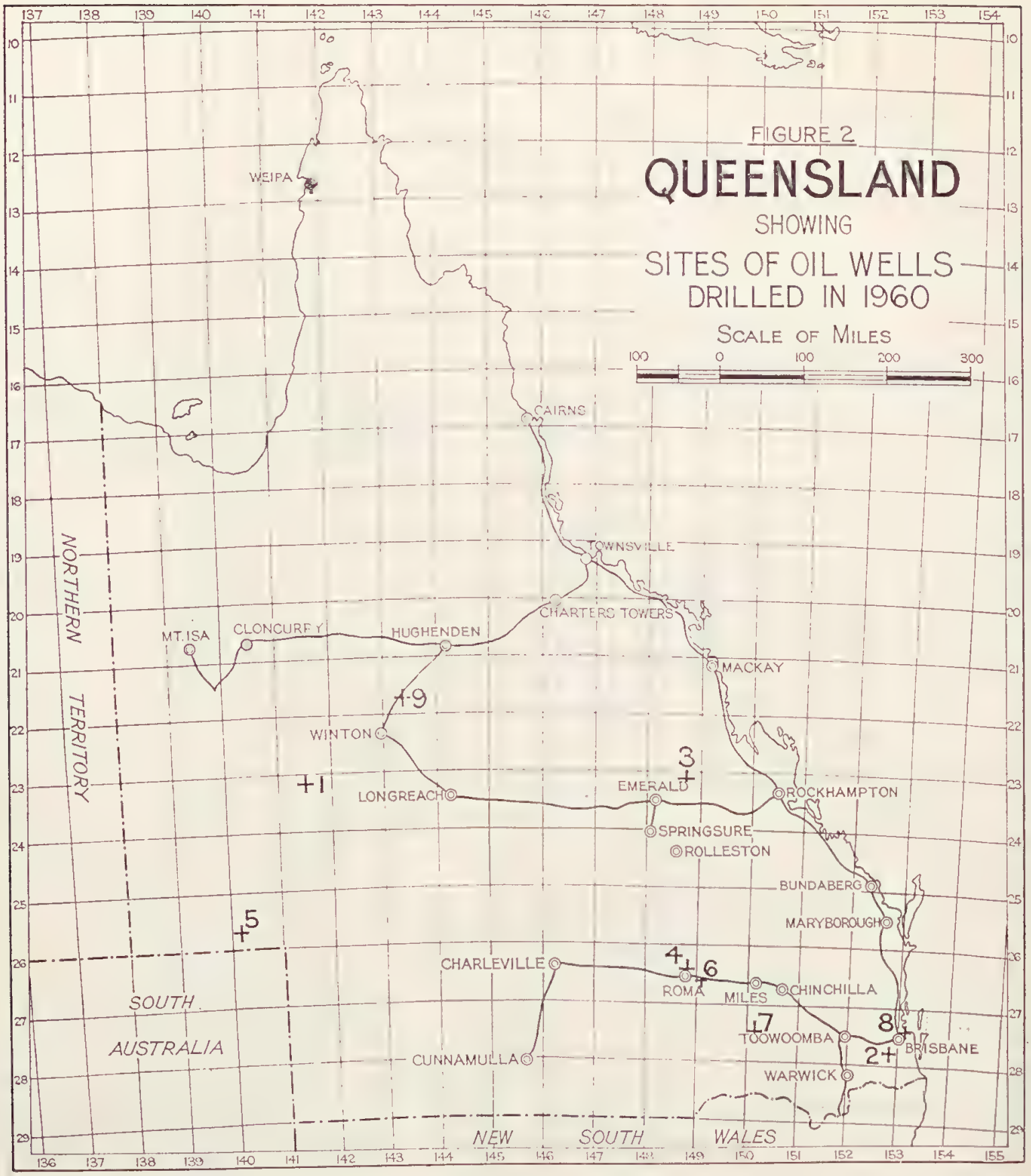


FIGURE I.
QUEENSLAND
Showing
APPROXIMATE AREAS COVERED BY
AUTHORITIES TO PROSPECT AND
PROSPECTING PETROLEUM PERMITS AS AT 31ST DEC. 1960
SCALE OF MILES
100 50 0 100 200 300
L.P.H. 10-1-61
58P.
61P.
65P.
64P.
79P.
54P.
80P.
AREA 'A'
64P.
75P.
83P.
84P
66P.
67P.
60P.
72P.
76P.
81P.
80P.
AREA 'B'
55P.
56P.
77P.
78P.
70P.
71P.
57P.
82P.
Normanton
Croydon
Forsayth
Cairns
Townsville
Charters Towers
Cloncurry
Mt Isa.
Hughenden
Mackay
Winton
Muttaburra
Clermont
Longreach
Rockhampton
Blackall
Rolleston
Jundah
Tambo
Taroom
Maryborough
Charleville
Quilpie
Roma.
Surat
Toowoomba
BRISBANE
Cunnamulla
Dirranbandi
P.P.P.709
P.P.P.705(Pt)
P.P.P.705(Pt)
P.P.P.706
P.P.P.697
P.P.P.707
P.P.P.708
P.P.P.704
※ 6½ acres Excluded Area (Z.C.L. No 1 Weipa Well)



INDEX

No.	Well	Latitude	Longitude	R.L. of Rotary Table	Height of Rotary Table
1	Conorada Ooroonoo No. 1	23° 10′ 50″	141° 33′ 09″	405′	5′
2	Queensland American The Overflow No. 1 ..	27° 48′ 30″	152° 51′ 04″	194′	11′
3	AFO No. 1 (Cooroorah)	23° 07′ 30″	148° 42′ 40″	605′	10′
4	AAO Timbury Hills No. 2	26° 33′ 38″	148° 49′ 38″	1110′	10′
5	DFS No. 1 (Betoota)	25° 42′ 30″	140° 49′ 46″	359′	14′
6	AAO Pickanjinnie No. 1	26° 35′ 42″	149° 07′ 18″	1069′	10′
	AAO Latemore No. 1	26° 35′ 13″	149° 04′ 35″	1075′	10′
	AAO Latemore East No. 1	26° 35′ 36″	149° 05′ 40″	1045′	10′
7	Union–Kern–AOG Cabawin No. 1 ..	27° 28′ 16″	150° 11′ 19″	966·9′	15·5′
8	Standard Gas Cribb Island No. 1	27° 22′ 26″	153° 07′ 03″	6′	1′ Ht. of Collar
9	Magellan Corfield No. 1	21° 42′ 40″	143° 22′ 30″	847′	5′

Table A—*continued*

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
	Sq. Miles			
		AUTHORITIES TO PROSPECT—*continued*		
72P ..	35,000	Sunray Mid-Continent Oil Company (50 per cent.) and Phillips Petroleum Company (50 per cent.). Operator, Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 863L, G.P.O., Brisbane	Charleville	Geological and Geophysical Investigations
75P ..	8,300	Conorada Petroleum Corporation: B. V. Uhl, President, 630 Fifth Avenue, New York, U.S.A.; I. McPhee, Resident Geologist, 74 Seventh Avenue, St. Lucia, Brisbane	West of Longreach ..	Geological Investigations
76P ..	57,900	Artesian Basin Oil Company Pty. Ltd.; Gene Goff, Chairman, 305 Pan American Building, Tulsa 3, Oklahoma, U.S.A.; C. W. Siller, Managing Director, Box 1555V, G.P.O., Brisbane	Hughenden	Geological Investigations
77P ..	12,000	Reef Oil Company Pty. Ltd.: Gene Goff, Chairman, 305 Pan American Building, Tulsa 3, Oklahoma, U.S.A.; C. W. Siller, Managing Director, Box 1555V, G.P.O., Brisbane	Mackay	Geological Investigations
78P ..	19,400	Nortex Australian Oils Ltd.: J. R. Wendover, President, 1900 Life of America Building, Dallas, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Rockhampton–Mundubbera	Geological Investigations
79P ..	40,000	Australamerica Corporation: H. J. Steel, President, 527 Madison Avenue, New York 22, New York, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cloncurry-Mount Isa ..	Suspended
80P ..	Area A 5,000	Magellan Petroleum Corporation (75 per cent.) and Central Queensland Petroleum Coy. Pty. Ltd. (25 per cent.). Magellan: B. W. Heath, President, 103 East 37 Street, New York, U.S.A.; H. I. Harris, Chief Geologist, Australia, Box 455F, G.P.O., Brisbane. Cent. Qld.: R. F. G. Wilson, Agent, Box 1555V, G.P.O., Brisbane. Operator, Magellan	Winton	Geological Investigations
	Area B 18,000	Magellan Petroleum Corporation: B. W. Heath, President, 103 East 37 Street, New York, U.S.A.; H. I. Harris, Chief Geologist Australia, Box 455F, G.P.O., Brisbane	Tambo	
81P ..	19,500	Oil Development N.L.: K. W. Craig, Chairman, 100 Collins Street, Melbourne. Geo-Surveys of Australia Pty. Ltd. (R. C. Sprigg, Managing Director), Geological Consultants, Box 1479L, G.P.O., Adelaide; L. W. Doggett, Agent, Box 281D, G.P.O., Brisbane	Alpha	Suspended
82P ..	82,000	Triton of Australia Ltd.: T. H. Dunn, President, Vaughn Building, Dallas, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cairns	Suspended
83P ..	9,300	Cordillera–Australian Petroleum Company Pty. Ltd.: R. P. Greson, President, 827 Mercantile Securities Building, Dallas, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Isisford	Suspended
84P ..	9,600	Sunray Mid-Continent Oil Company (50 per cent.) and Phillips Petroleum Company (50 per cent.) Operator, Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 863L, G.P.O., Brisbane	Yaraka	Geological and Geophysical Investigations
Total ..	807,540	Square miles.		

* In these areas 54P, 55P, 56P, and 65P, Associated Australian Oilfields No Liability, Associated Freney Oil Fields No Liability, and The Papuan Apinaipi Petroleum Co. Ltd., are jointly associated.

In respect of 54P, Phillips–Sunray (For details of Company names and Principal Officers, see 72P and 84P) have an option over 50 per cent. of this area on a checkerboard basis and in pursuance of this option Phillips are the present operators.

In respect of 55P, 56P, and 65P, the operators are a subsidiary Company—Mines Administration Pty. Ltd. (In future this Company will operate under the name "Petex"), E. N. Avery, Managing Director, D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane.

Summarised Table A represents seven Prospecting Petroleum Permits totalling 1,288 square miles and twenty-four Authorities to Prospect totalling 807,540 square miles.

The following titles were relinquished during the year (Table B):—

Table B

No.	Holder	Locality	Remarks
		Prospecting Petroleum Permits	
		Nil	
		Authorities to Prospect	
53P ..	Humber Barrier Reef Oils Pty. Ltd. ..	Barrier Reef	Surrendered
62P ..	Magellan Petroleum Corporation (75 per cent.) and Central Queensland Petroleum Co. Pty. Ltd. (25 per cent.)	Winton	Surrendered and merged in 80P
63P ..	Magellan Petroleum Corporation ..	Tambo	Surrendered and part merged in 80P
73P ..	Stekoll Australian Petroleum Ltd. ..	Cairns–Townsville–Georgetown ..	Surrendered
74P ..	Australian American Oil Company Pty. Ltd.	Isisford	Surrendered and merged in 83P (part) and 84P (balance)

PART 3—SURFACE PROSPECTING

The following details of work done in surface geology, geophysical surveying and prospecting during 1960 have been obtained from the titleholders and by personal inquiry and observation. In addition work done by Government agencies is described.

Prospecting Petroleum Permits

P.P.P. 697.—No field work was carried out on this permit during the year, but geological data available was reviewed.

P.P.P. 704.—A well was commenced at Cribb Island at the beginning of March (Standard Gas Cribb Island No. 1) and at the end of the year drilling was continuing with a percussion plant at a depth of 1,420 ft. In addition a scout bore was sunk at Aspley to a depth of 970 ft.

P.P.P. 705.—No field work was carried out on this permit during the year, but geological and geophysical data available was reviewed.

P.P.P. 706.—No field work was carried out on this permit during the year, but geological data available was reviewed.

P.P.P. 707.—No field work was carried out on this permit during the year, but geological data available was reviewed.

P.P.P. 708.—After suspending fishing and recovery operations to recover the tools lost in the well C.O.L. No. 1 (Speculation) for six months these were resumed in April and the company continued recovery operations (without success) until the end of the year. There was no advance in the depth of the well.

P.P.P. 709.—No field work was carried out on this permit during the year.

Authorities to Prospect

53P.—This title was surrendered at the end of August. No field work had been done on the authority during 1960 up to the time of surrender.

54P.—As indicated in Table A an option over 50 per cent. of the area (on a checkerboard basis) of this Authority was granted in the middle of the year and the option holders are the present operators. The geological data obtained on this area was carefully reviewed and a seismic crew was employed on reconnaissance seismic survey of part of the area covering 2,000 square miles throughout the second half of the year.

55P and 56P.—As indicated in Table A these Authorities were amalgamated during the year and accordingly activities in respect of them are recorded under the one heading. Work on these areas was undoubtedly the most active of any part of Queensland during 1960. One well A.F.O. No. 1 (Cooroorah) was completed and four other wells (A.A.O. Timbury Hills No. 2, A.A.O. Pickanjinnie No. 1, A.A.O. Latemore No. 1 and A.A.O. Latemore East No. 1) were also drilled for a total footage of 19,813 ft. Geological work consisted of mapping in both the Injune and Banana areas, and well site geology at the five wells. Subsequently detailed reports were received on this and other work. Some experimental geochemical work was also done in selected parts of the authorities and a general geological control maintained over the activities on the authorities. 8.9 crew months were spent in both regional and detailed seismic work to the north, south and east of Roma and in the Banana district. It was a result of this seismic work that the last four wells were drilled, of which two (Timbury Hills No. 2 and Pickanjinnie) were established as potential gas wells. The area covered by the seismic surveys totalled 1,490 square miles.

57P.—It was noted last year that operations in this area are now conducted by an overseas company and during the past year there has been a very active geological, geophysical and finally drilling programme on this authority. The initial well drilled (Union-Kern-A.O.G. Cabawin No. 1—Plate 4) had reached 9,952 ft. at the end of the year. The geological work consisted firstly of literature studies of the Bowen and Surat Basin, followed by reconnaissance and detailed surveys of the same basins, geological work in connection with the seismic surveys undertaken and well site work at Cabawin No. 1. Geophysical prospecting on the area comprised two months of aerial magnetometer surveys covering an area of 3,000 square miles in the Cabawin district and 8.3 crew months of seismic surveys in Cabawin, Glenmorgan and Miles district, traversing in all 287 miles.

58P.—Owing to unforseen difficulties arising in connection with the proposed drilling of a test well on Mornington Island no field work in connection with Authority was undertaken during the year. Further geological studies of data previously obtained were made and equipment obtained with a view to use in the proposed well which is to be commenced in about May 1961, and the well site and road to the same were cleared.

60P.—Only scout drilling and a review of the geological data obtained therefrom was carried out on this title during the year. One scout bore was completed and another commenced for a total footage of 3,508 ft. in 1960.

61P.—No work was done on this authority during the period. Proposals have been made to drill a stratigraphic well in the Laura Basin area during the dry season of 1961.

62P.—This title was surrendered at the end of March 1960 and merged in 80P. Prior to that date no field work was done on this authority during 1960.

63P.—This title was surrendered at the end of March 1960 and part of it merged in 80P. Prior to such surrender a gravity survey had been done covering an area of 950 square miles on this authority.

64P.—With the exception of a ½ crew month of seismic prospecting in the middle of the year, traversing 60 miles to the west of Longreach practically no work was done on this authority during the year.

65P.—No work was undertaken on this authority during the year.

66P. and 67P.—These two authorities which are checkerboarded and interrelated are dealt with together. They have been the subject of intensive work during the year comprising geological mapping of areas peripheral to the Great Artesian Basin, seismic surveys and the completion of the well D.F.S. Betoota No. 1 at a depth of 9,824 ft. as a dry hole. The geological examination of outcrops of pre-Mesozoic rocks was made in South Australia, New South Wales and the Northern Territory with a view to obtaining a better knowledge of the pre-Mesozoic rocks beneath the Great Artesian Basin. As subsequently recorded the South Australian Department of Mines ran a seismic traverse from Boulia, Qld., to Clifton Hills, S.A. In addition detailed seismic work was done for the title-holders in the Innamincka-Durham Downs area; this comprised 2.1 crew months traversing 77 miles.

70P.—The only work done on this area during the year was a review of the geological and geophysical data available.

71P.—No surface work was done on this Authority during the period, but the well Queensland American The Overflow No. 1 was drilled to a depth of 2,993 ft. and plugged as a dry well. The site of this well was on the South Moreton Anticline in the Beaudesert district.

72P.—This authority was the subject of a very active programme during the year. Geological investigations consisted of photo-geological reconnaissance, air and ground reconnaissance, review of available literature and a compilation of water bore data. Geophysical work was both by aero magnetic means and seismic methods. In the case of the former these comprised three party months of aerial magnetometer survey covering an area of 35,000 square miles, whilst in regard to the latter an area of 4,500 square miles was covered in seventeen crew months. This detailed programme was the precursor to the selection of a deep drilling target in 1961.

73P.—This title was surrendered in May 1960. Prior to its surrender no work was done on it.

74P.—This title was surrendered at the end of June and merged in Authorities to Prospect 83P (part) and 84P (balance). Prior to that date the results of the reconnaissance air photo interpretations carried out the previous year were reviewed.

75P.—A photogeological evaluation of this authority was prepared by an American firm of consultants and a review was made of all the geological data available. Consequent upon this work a stratigraphic well (Conorada Ooroonoo No. 1) was drilled to 3,852 ft. and plugged as a dry well.

76P.—The data obtained from this reconnaissance seismic survey in the Muttaburra district of this area in late 1959 was interpreted and reviewed. Subsequently a geological survey was carried out for four months in the Lake Galilee district.

77P.—The petroleum possibilities of the Styx River district of this area were examined and reported on by the Company's consultants.

78P.—The titleholder completed an office research on material available on this area and a consultant made a field reconnaissance trip over the area and reported on the same.

79P.—No work was carried out on this area during the year.

80.P.—This title commenced in April and subsequently the company has been re-interpreting the gravity and magnetometer data previously obtained and has initiated a regional study of the geology of the outcrops surrounding the Great Artesian Basin. To assist in this work the company extended a water bore as a stratigraphical well (Magellan Corfield No. 1) drilling 1,877 ft. to a total depth of 4,507 ft. This petroleum potential of the well was negative and the well was completed as a water bore.

81P.—No work was carried out on this authority during the year.

82P.—No work was carried out on this area in 1960.

83P.—No work was done on this title during the year.

84P.—A review was made of the literature available and water bore data was compiled. An aerial magnetometer survey of the title was completed.

Regional Geological Surveys

The Bureau of Mineral Resources in conjunction with the Geological Survey of Queensland undertook a fairly extensive programme of regional surveys to assist the search for oil in Queensland in 1960.

In the Bowen Basin area these comprised the mapping of the Mount Coolon four mile sheet with one party for 17 geologist months, and the mapping of the Clermont four mile sheet by another party for 20 geologist months.

In the Great Artesian Basin area in far western Queensland four and a-half four mile sheets were mapped by a further party during 14½ geologist months.

Data obtained by this survey is basic to the proper understanding of these basins and their petroleum prospects.

Regional Geophysical Surveys

The Bureau of Mineral Resources conducted a variety of geophysical surveys in Queensland in 1960. These comprised water bore logging, gravity surveys and seismic survey. The water bore logging programme was experimental to determine the value of such work and conducted mainly in the southern part of the State over 26 bores.

The gravity surveys of the Bureau comprised a reconnaissance survey of the Mount Whelan area in far Western Queensland by helicopter, traversing 600 miles, regional surveys in southern and eastern Queensland traversing 4,725 miles and a semi-detailed survey in central Southern Queensland traversing 350 miles. These traverses are of great value in determining sub-surface structure.

The seismic programme of the Bureau of Mineral Resources comprised regional surveys in the Roma–Surat–Dalby area for four party months, and further regional surveys in the Emerald–Duaringa area and west of Winton for periods of 3½ and ½ party months respectively. The work in Southern Queensland and the Bowen Basin is proving particularly valuable and makes possible a new and very valuable interpretation of the Pre-Mesozoic strata in these areas.

The South Australian Department of Mines ran a regional reconnaissance seismic correlation line from Breadalbane (near Boulia) to Birdsville, then east to Betoota, all in Queensland, subsequently they carried this line further from Birdsville to Clifton Hills in South Australia. In all this traverse covered 255 miles in Queensland. The purpose of this work was to carry reflections obtained in areas of identified Lower Paleozoic rocks, as in water bores near Boulia into the deep parts of the Great Artesian Basin where Paleozoic rocks are not yet satisfactorily identified.

PART 4—GEOPHYSICAL SURVEYS

The following tables detail the water bore logging, gravity, aerial magnetometer and seismic work done in Queensland in 1960.

The water bore logging (Table C) was a project jointly conceived and sponsored by the Qupex Group, the Irrigation and Water Supply Commission, the Bureau of Mineral Resources and the Department and was an excellent example of co-operative effort. The results obtained from it could be very valuable in correlating the upper Mesozoic section of the Great Artesian Basin and extending the knowledge of aquifers.

Table C

WATER BORE LOGGING

Locality: From Roma west to Eromanga, with a southerly sweep nearly to the Border. Also town bores at Winton, Corfield, and Mitchell.

Arranged by: Qupex, Department of Development and Mines, Irrigation and Water Supply Commission and Bureau of Mineral Resources, Geology and Geophysics.

Operator: B.M.R. Geophysical (Logging) Party.

Crew Months: 4—1 Geophysicist, and 1 Technician or 1 Assistant Geophysicist.

Gamma Ray: 24 bores logged—48,000 ft. of logging.

Temperature: 6 bores logged—12,600 ft. of logging.

S.P.-Resistivity: 2 bores logged—5,850 ft. of logging.

Caliper: 1 bore logged—1,300 ft. of logging.

Gravity surveys (Table D) by companies were limited in 1960, but the Bureau of Mineral Resources had a very extensive programme.

Table D

GRAVITY SURVEYS

Title	Operator	Contractor	Party Months	Area covered in Square Miles	Number of Line Miles Traversed	Number of Stations
63P ..	Magellan Petroleum Corporation	Century Geophysical Corporation	3	950	750	1,449

By Government Agencies

Surveys Conducted by the Bureau of Mineral Resources, Geology and Geophysics

Area of Operation	Type of Survey	Party Months	Area covered in Square Miles	Number of Line Miles Traversed	Number of Stations
Mount Whelan (Western Queensland)	Reconnaissance by Helicopter	1¼	3,500	600	80
Thargomindah–Quilpie–Charleville–Roma–St. George–Toowoomba–Brisbane	Regional (Party 1) ..	1¾	..	1,225	225
Brisbane–Townsville–Cairns Hughenden–Emerald–Roma–Dirranbandi	Regional (Party 2)..	4	..	3,500	800
Thargomindah–Cunnamulla–Quilpie–Charleville	Semi-detailed (Party 2)	2¼	..	380	305

Table E

AERIAL MAGNETOMETER SURVEYS

Title	Operator	Contractor	Field Party Months	Area Covered in Square Miles	Number of Line Miles Flown
57P ..	Union Oil Development Corporation	Adastra Hunting Geophysics Pty. Ltd.	2	3,000	3,463
72P ..	Phillips Petroleum Company	Aero Service Corporation	3	35,000	13,277
84P (and part of 60P) ..	Phillips Petroleum Company	Aero Service Corporation	1	13,500 (includes 3,900 square miles in 60P)	4,634

Aerial Magnetometer Surveys (Table E) were used by two companies to obtain confirmatory bedrock evidence to be used in conjunction with seismic surveys undertaken by them. The very compact unit and small crew operated by one contractor was of special interest as showing the ready adaptability of this method for relatively small jobs.

With a total of 54.35 crew months of operation in Queensland in 1960 seismic prospecting became the major exploration tool in use. The compilation (Table F) shows the magnitude of the work undertaken. It will be noted that not all operators and contractors use the same nomenclature and classifications; consequently there is a little confusion in making a summation of the data. The drilling of Timbury Hills No. 2, Pickanjinnie No. 1 and Cabawin No. 1 have more than justified this seismic expenditure and it is to be expected that the tool will be used still more in 1961.

PART 5—OIL AND NATURAL GAS DRILLING

This work, including scout structure drilling, was in progress on two Prospecting Petroleum Permits (P.P.P.'s 704 and 708) and seven Authorities to Prospect (Nos. 55P, 56P, 57P, 60P, 66P, 71P and 75P) during the year.

The sites of wild cat wells, excluding scout structure bores, drilled during 1960 is shown on the accompanying plan (Fig. No. 2). Sites of wells drilled prior to 1959 are shown in the previous annual reports.

Table F

SEISMIC SURVEYS

Title	Operator	Contractor	Crew Months	Type of Survey	Method of Survey	Area Surveyed	Length of Traverses	Number of Profiles	Number of Observation Points	Holes Drilled	Feet Drilled	Explosive Used	Detonators Used
						Sq. Miles	Miles				Ft.	Lb.	
54P ..	Phillips Petroleum Company	Austral Geo-Prospectors Pty. Ltd.	6·0	Regional reconnaissance	Mainly spot correlation (reflection) with limited continuous profiling (reflection)	2,000	480	..	743	1,131	120,051	10,139	2,061
55P and 56P	Mines Administration Pty. Ltd.	Austral Geo-Prospectors Pty. Ltd.	8·9	Mainly detailed with some regional lines	Continuous profiling (reflection)	1,490	298	..	1,322	1,306	125,492	43,317	2,341
57P ..	Union Oil Development Corporation	United Geophysical Inc.	8·3	Reconnaissance	Continuous profiling (reflection)	..	287	1,182	1,123	1,181	184,424	54,680	2,163
64P ..	Cree Oil of Canada (1958) Pty. Ltd.	Austral Geo-Prospectors Pty. Ltd.	0·5	Reconnaissance	Spot correlation (reflection)	..	60	..	57	58	9,960	1,000	126
66P and 67P	Delhi Australian Petroleum Ltd.	South Australian Department of Mines	2·1	Reconnaissance and detailed	(*a*) Detailed continuous reflection profiling	..	19·3	89	..	91	9,923	2,777	101
					(*b*) Reconnaissance reflection correlation	..	57·5	33	..	34	3,781	1,726	43
					(*c*) Reconnaissance reversed in line refraction	..	..	4	129	83	9,840	8,170	216
72P ..	Phillips Petroleum Company	Petty Geophysical Engineering Company	17·0	Mainly reconnaissance with some detail	Continuous profiling (reflection)	4,500	840	..	2,039	3,951	418,169	63,063	7,618
By Government Agencies													
South Australian Department of Mines Regional Traverse (Boulia, Queensland, to Clifton Hills, South Australia) Queensland Section			3·55	Regional ..	(*a*) Wide internal reflection correlation	..	255 (Altogether in Qld.)	223	143 (Altogether in Qld.)	171	11,600	2,241	236
					(*b*) Single line refraction with accompanying continuous reflection profiling	..	..	334	..	159	13,457	5,720	383
Bureau of Mineral Resources, Geology and Geophysics— (i.) Cabawin–Jondaryan and Roma–Surat areas			4·0	Regional ..	Continuous reflection profiling at selected intervals and reverse line refraction profiles	..	150 (reflection traverse)	413 (reflection)	413 (reflection)	458	56,382	14,000	822
							103 (continuously shot)	4 (refraction)	45 (refraction)	..	..	..	..
(ii.) Bowen Basin (Emerald–Duaringa area)			3·5	Regional ..	Continuous reflection profiling at selected intervals and reverse line refraction profiles	..	130 (reflection traverse)	232 (reflection)	232 (reflection)	459	35,536	17,500	1,092
							58 (continuously shot)	11 (refraction)	38 (refraction)	..	..	..	..
(iii.) Winton area (north-west from Winton for 21 miles along McKinlay Road)			0·5	Regional ..	Continuous profile reflection	..	8½	34	34	39	4,944	1,304	74
Total			54·35						Total ..	9,121	1,003,599	225,637	17,276

The following Table G shows the footages of wells drilled in 1960 in chronological order. All these wells are classed as wild cat wells or scout bores in accordance with the accepted practice of the oil industry. All footages mentioned in this table represent depths measured from the rotary table or casing head (in percussion wells):—

Table G

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remarks as at End of Year
				Ft.	
Rotary Drilling					
A.F.O. No. 1 (Cooroorah)	Cooroorah, via Capella (56P)	Associated Freney Oil Fields N.L., with whom are associated Associated Australian Oilfields N.L. and the Papuan Apinaipi Petroleum Co. Ltd. (Mines Administration Pty. Ltd.)	701	3,523	Plugged as a dry well
D.F.S. No. 1 (Betoota)	Betoota, South-Western Queensland (66P)	Delhi Australian Petroleum Ltd., with whom are associated Frome-Broken Hill Co. Pty. Ltd. and Santos Ltd. (Delta Drilling Co.)	8,123	9,824	Plugged as a dry well
A.A.O. Timbury Hills No. 2	Timbury Hills, North-East of Roma (55P)	Associated Australian Oilfields N.L., with whom are associated Associated Freney Oil Fields N.L. and the Papuan Apinaipi Petroleum Co. Ltd. (Mines Administration Pty. Ltd.)	4,400	4,400	Tested as a gas well and awaiting completion
Queensland American The Overflow No. 1	Between Beaudesert and Boonah, South-Eastern Queensland (71P)	Queensland American Oil Company with whom are associated Phillips Petroleum Company and Sunray Midcontinent Oil Company (Mines Administration Pty. Ltd.)	2,993	2,993	Plugged as a dry well
Magellan Corfield No. 1	Corfield (Hughenden-Winton Line) Central Queensland (80P)	Magellan Petroleum Corporation with whom are associated Central Queensland Petroleum Coy. Pty. Ltd. (W. L. Sides and Son Pty. Ltd.)	1,877	4,507	Deepened as a stratigraphic test well below 2,630, plugged as a dry well and converted to a water well
A.A.O. Pickanjinnie No. 1	Pickanjinnie, 20 miles East of Roma (55P)	Associated Australian Oilfields N.L., with whom are associated Associated Freney Oil Fields N.L. and the Papuan Apinaipi Petroleum Co. Ltd. (Mines Administration Pty. Ltd.)	5,213	5,213	Tested as a gas well and awaiting completion
Conorada Ooroonoo No. 1	Mackunda Creek, 160 miles West of Longreach (75P)	Conorada Petroleum Corporation (Mines Administration Pty. Ltd.)	3,852	3,852	Plugged as a dry well
A.A.O. Latemore No. 1	17 miles East of Roma (55P)	Associated Australian Oilfields N.L., with whom are associated Associated Freney Oil Fields N.L., and the Papuan Apinaipi Petroleum Co. Ltd. (Mines Administration Pty. Ltd.)	4,775	4,775	Gas show, plugged
A.A.O. Latemore East No. 1	18 miles East of Roma (55P)	Associated Oilfields N.L., with whom are associated Associated Freney Oil Fields N.L. and the Papuan Apinaipi Petroleum Co. Ltd. (Mines Administration Pty. Ltd.)	4,724	4,724	Gas show, plugged
Union-Kern-A.O.G. Cabawin No. 1	26 miles South-West of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	9,952	..	Drilling
Percussion Drilling					
C.O.L. No. 1 (Speculation)	Chinchilla (P.P.P. 708)	Condamine Oil Ltd.	..	..	Fishing for lost tool at 2,333 feet—current depth
Standard Gas Cribb Island No. 1	Cribb Island, Brisbane (P.P.P. 704)	Standard Gas Pty. Ltd. (Godfrey Bros. Pty. Ltd.)	1,420	..	Drilling

Table G—*continued*

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remark as at End of Year
				Ft.	
		SCOUT BORES			
		(*Percussion*)			
Smart Oil Harkaway Scout No. 1	Harkaway, via Eromanga, South-Western Queensland (60P)	L. H. Smart Oil Exploration Ltd. (J. R. Robinson)	1,850	1,850	Abandoned
Smart Oil Orient Scout No. 1	Orient, via Thargomindah, South-Western Queensland (60P)	L. H. Smart Oil Exploration Ltd. (J. R. Robinson)	1,658	..	Suspended, limit of rig
Standard Gas Aspley Scout No. 1	Aspley, Brisbane (P.P.P. 704)	Standard Gas Pty. Ltd., (S. H. Scells)	970	..	Suspended, limit of rig

Summarised the above details are shown in the following table:—

Table H

WILD CAT DRILLING

Footage drilled during year (1,420 feet percussion, balance rotary)	47,030 ft.
Number of wells drilling at 31st December, 1960	Two
Number of wells drilled and completed in year and results	Nine (Five dry, Two gas shows plugged, and Two tested as gas wells and awaiting completion)

SCOUT DRILLING

Footage drilled during year (all percussion) ..	2,478 ft.
Number of bores drilling at 31st December, 1960	Nil
Number of bores drilled during the year ..	Three

Specific details of the various wells and scout bores drilled during the year appear in the Geological Survey Report on Drilling for Petroleum, previously referred to. Records of previous wells and bores appear in earlier reports.

PART 6—EMPLOYMENT AND ACCIDENTS

Employment increased steadily throughout the year, reflecting the increased tempo of activity. The increase for the year was 139 per cent. On present indications employment in 1961 will be even greater.

With increased employment it has been found possible to give statistics in more detail, by dividing drilling and the employment by Government agencies into categories separate from other employment by titleholders. These results are shown in the following Table I, being the average employment throughout the State during 1960, and which totals 289:—

Table I

EMPLOYMENT

Administrative Geologists Geophysicists, &c.		Other		Managers, Petroleum Engineers, Toolpushers, Drillers, &c.		Derrick and Floormen		Miscellaneous Others	
Titleholders Employees	Contractors Employees	Titleholders Employees	Contractors Employees	Titleholders Employees	Contractors Employees	Titleholders Employees	Contractors Employees	Titleholders Employees	Contractors Employees
EMPLOYED BY OPERATORS									
27	44	22	102	13	10	15	15	8	8
								Total ..	264
EMPLOYED BY GOVERNMENT AGENCIES									
Technical Personnel 11	..	Other 14	..	..	..	..	..	..	Total 25
38	44	36	102	13	10	15	15	8	8
									Total 289

Regular accident statistics have been compiled only in respect of drilling operations. They are detailed in the following Table J:—

Table J

DETAILED CLASSIFICATION OF ACCIDENTS
(All Lost Time)

Nature of Injuries	Occupation					Injured Member								Agency of Injury					
	Toolpushers	Drillers, &c.	Floormen and Derrickmen	Miscellaneous	Total	Fingers	Hands	Arms	Toes	Feet	Legs	Head	Body	Total	Moving Machinery	Using Tools	Handling Drillpipe, &c.	Falling Objects	Miscellaneous	Total
Contusions and Abrasions ..	..	..	3	1	4	..	..	..	..	..	1	..	2	3	..	1	1	..	2	4
Cuts and Lacerations	1	..	3	..	4	1	1	1	..	1	1	1	..	6	..	2	1	..	2	5
Fractures	..	..	2	1	3	2	..	..	..	..	..	..	..	2	..	..	2	..	..	2
Burns	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1	..	8	2	11	3	1	1	..	1	2	1	2	11	..	3	4	..	4	11

No fatal or very serious accidents were recorded.

PART 7—LEGISLATION AND INSTRUCTIONS ISSUED TO OPERATORS

There were no changes in the legislation governing the industry, *"The Petroleum Acts, 1923 to 1958,"* during the year. A minor change was made to the instructions issued to operators stating the correct sample requirements of the Commonwealth subsidised wells. The instructions with this correction were re-issued to all operators.

PART 8—GENERAL SURVEY OF INDUSTRY

The overseas interest in Queensland's oil potential which was the characteristic of 1959 has been more than maintained in 1960, by very large expenditures by American "Independents" in Queensland.

The estimated expenditure by all companies in oil exploration in Queensland in 1959 was £450,000. In 1960 it was £1,900,000, and in 1961 based on proposed programmes it should be between four and five million.

As at the end of the year, with the exception of the greater part of the Barrier Reef the whole of the State was held under title. The seven P.P.P.'s were held by five interests (one interest holding three titles). In respect of the authorities, due to joint interests, these twenty-four are actually held by fifteen separate groups of interests. Eleven of these authorities comprising somewhat less than half the total area of the State were held by solely overseas interests, eight comprising not quite a third of the State were held jointly by overseas and Australian interests whilst the remaining five authorities and all the P.P.P.'s comprising a little less than a quarter of the State's area are held solely by Australian interests.

The dry wells at Betoota, Cooroorah, The Overflow, Corfield, Ooroonoo, Latemore and Latemore East, supplied considerable data which has permitted the re-interpretation of much of the knowledge on our sedimentary basins, particularly the Great Artesian Basin. The promise of potential gas fields from the Timbury Hills No. 2, Pickanjinnie No. 1 and Cabawin wells has given tremendous hope for the future. The footage of wells drilled during the year, though not a record, approached with a total of 47,030 ft. the record of 1955. However, the 1960 wells were infinitely better located, and showed some success as against the negligible results of 1955. The great increase in seismic prospecting gave promise of many well sites in 1961.

The prospective use in 1961 of the gas from A.A.O. No. 4 (Hospital Hill) and A.A.O. Timbury Hills No. 2 to operate gas engines at the Roma Town Council power house is a development of importance that could be a lead to future utilisation of gas for power.

Undoubtedly the highlights of the year were the testing of the 6.25 m.m.c.f. per day well at Pickanjinnie No. 1 and the discovery early in December of high pressure petroliferous gas at 9935 feet in Cabawin No. 1.

The testing of Cabawin No. 1 in 1961 is now awaited with intense interest.

If the rates of expenditure continue, with increased geological and geophysical data obtained and better siting of wells, we should in 1961 be nearer to our goal of commercial oil.

DRILLING

By R. J. ALLEN and I. G. SANKER, Geologists

A.A.O. TIMBURY HILLS No. 2

This well was located at lat. 26° 33′ 38″ S., long. 148° 49′ 38″ E., approximately three miles east-north-east of Roma, to test the "Hospital Hill Sandstone" in a seismic high (the Timbury Hills Anticline). The drilling contractor was Mines Administration Pty. Ltd. and the rig a National T–32. Rotary table elevation was 1,110 ft. Drilling began on 29th February, 1960, and the total depth of 4,400 ft. was reached on 4th April. The electric logging only, of this well was subsidised by the Commonwealth Government under the *Petroleum Search Subsidy Acts,* 1957-59.

Twelve and one-quarter inch hole was drilled to 178 ft., and 9⅝ in. 40 lb. casing was run and cemented to surface. Eight and one-half inch hole was drilled from 178 ft. to total depth. Six and five-eighths inch 20 lb. casing was run to 3,792 ft.

Eight conventional cores were taken, all in the lower section of the hole; four were taken between 3,691 ft. and 3,742 ft., two between 3,915 ft. and 3,939 ft., one at 4,300–4,304 ft., and one at 4,394–4,400 ft. Sidewall cores were taken between 3,746 ft. and 3,765 ft., at 1 ft. intervals. Schlumberger ran an electric log from 179–4,304 ft., micrologs at 1,760–1,960 ft., 2,580–3,250 ft., 3,700–3,740 ft. and 3,755–3,765 ft., a section gauge from 177–4,302 ft., a velocity survey upwards from 4,302 ft. and an unsuccessful dipmeter survey. Mines Administration Pty. Ltd. ran an electric log from 179–4,200 ft., and a gamma log from 0–4,304 ft.

The stratigraphic succession was reported as:—

0– 300 ft.	Roma Formation	
300– 515 ft.	"Transition Beds"	Blythesdale Group
515– 695 ft.	Mooga Sandstone	Blythesdale Group
695– 875 ft.	"Fossil Wood Beds"	Blythesdale Group
875–1,375 ft.	Gubberamunda Sandstone	Blythesdale Group
1,375–2,590 ft.	Walloon Coal Measures	
2,590–3,305 ft.	Bundamba Sandstone	
3,305–3,843 ft.	Moolayember Formation	
3,843–4,400 ft.	Timbury Hills Formation (basement)	

The "Hospital Hill Sandstone" (Moolayember Formation) was penetrated from 3,707–3,736 ft., the permeable section being from 3,712–3,724 ft. The "Links Sandstone" was encountered from 3,760–3,772 ft. The "Showground Sandstone" was not met.

The Timbury Hills Formation consists of steeply dipping siltstone with thin sandstone and shale laminations, all indurated and fractured. It underlies the Moolayember Formation unconformably. The age is pre-Mesozoic.

Ten formation tests were carried out:—

3,697–3,733 ft.	Gas (1,250 mcf)
4,140–4,400 ft.	Nil (packer not seating)
4,142–4,400 ft.	Nil (packer not seating)
3,595–3,792 ft.	Gas and water
3,585–3,792 ft.	Gas (515 mcf) and water (275 gph)
3,738–3,792 ft.	Testing equipment
3,685–3,731 ft.	Gas (396 mcf) and water (300 gph)
3,413–3,731 ft.	Testing equipment
3,685–3,730 ft.	Nil (tester clogged)
3,685–3,730 ft.	Gas (1,024 mcf)

The well was cased and perforated, awaiting equipping with tubing.

A.A.O. PICKANJINNIE No. 1

This well was located at lat. 26° 35′ 42″ S., long. 149° 07′ 18″ E., near Pickanjinnie, approximately 20 miles east from Roma, to test a closed seismic high. The drilling contractor was Mines Administration Pty. Ltd., using a National T–32 drilling rig. Ground elevation was 1,059 ft. and rotary table elevation (from which depth was measured) was 1,069 ft. Drilling commenced on 27th May, 1960, and total depth of 5,213 ft. was reached on 12th July. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter inch hole was drilled from surface to 184 ft., 178 ft. of 9⅝ in. 40 lb. casing then being run and cemented to surface. Eight and one-half inch hole was drilled from 184 ft. to total depth. Six and five-eighths inch 28 lb. casing was run to 4,497 ft. and cemented to 2,830 ft.

Twenty-two cores in all were cut, coring 194½ ft. with 78 per cent. recovery. Electric logs were run by Schlumberger from 178 ft. to total depth and micrologs from 3,910–4,945 ft. A section gauge, deviation surveys, temperature survey and velocity survey were also run. Rotary Engineering Co. operated an automatic gas detector from 2,500 ft. to total depth.

The stratigraphic units encountered in the well were reported to be:—

0– 365 ft.	Roma Formation	
365– 475 ft.	"Transition Beds"	Blythesdale Group
475– 750 ft.	Mooga Sandstone	Blythesdale Group
750– 937 ft.	"Fossil Wood Beds"	Blythesdale Group
937–1,428 ft.	Gubberamunda Sandstone	Blythesdale Group
1,428–2,898 ft.	Walloon Coal Measures	
2,898–3,448 ft.	Bundamba Sandstone	
3,448–4,185 ft.	Moolayember Formation	
4,185–4,490 ft.	Pickanjinnie Formation	
4,490–4,835 ft.	Latemore Formation	
4,835–5,213 ft.	Timbury Hills Formation	

The target beds were basal members of the Moolayember Formation:—

4,009–4,028 ft.	"Hospital Hill Sandstone"
4,044–4,054 ft.	"Links Sandstone"
4,178–4,185 ft.	"Showground Sandstone"

The Pickanjinnie Formation is Permian in age (on the evidence of the contained microflora). It consists of interbedded sandstone, siltstone and shale, with minor mudstone and coal. A slight unconformity separates this formation from the overlying Mesozoic rocks.

The Latemore Formation contains a similar microflora, and consists of interbedded sandstone, siltstone, shale, mudstone and coal seams.

The Timbury Hills Formation, which consists of fine grained, hard, quartzose sandstone grading in part to siltstone, is taken as local basement. Its dips in this bore are almost flat, in contrast with the steep dips found in A.A.O. Timbury Hills No. 2.

Petroliferous gas was met in the Moolayember Formation, and some minor hydrocarbon fluorescence, oil staining, oil and gas bleeding were noticed in the Permian section. Eight formation tests were run, the results of which are summarized below:—

3,952–4,030 ft.	Gas (2,414 mcf)
4,030–4,055 ft.	Gas (990 mcf)
4,137–4,290 ft.	Gas (25 mcf)
4,393–4,470 ft.	Nil (tester clogged)
4,393–4,470 ft.	Nil (equipment not working)
4,392–4,470 ft.	Gas (15 mcf)
3,976–4,368 ft.	Gas (5,603 mcf) Perf. 4,009–4,028 ft.
3,976–4,368 ft.	Gas (6,541 mcf) Perf. 4,009–4,028 ft. and 4,044–4,053 ft.

The hole was plugged from 4,520 ft. to total depth, filled with mud and capped, and completed as a gas producer on 29th July, 1960.

A.A.O. LATEMORE No. 1

This well was located at lat. 26° 35′ 13″ S., long. 149° 4′ 35″ E., about 18 miles east of Roma, to test Triassic and Permian sandstones in a seismic high (the Latemore Structure). The drilling contractor was Mines Administration Pty. Ltd., and the drilling rig a National T–32. Rotary table elevation was 1,075 ft. The well was spudded in on 12th August, 1960, and reached total depth of 4,775 ft. on 3rd September. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter inch hole was drilled from surface to 180 ft., and 9⅝ in. 40 lb. casing was run to 175 ft. and cemented to surface. Eight and one-half inch hole was drilled from 180 ft. to total depth.

Four conventional cores were cut, all in the lower part of the hole, below 4,000 ft. Schlumberger took 21 sidewall cores below 4,100 ft. Schlumberger also ran electric logs from 175–4,775 ft., and micrologs from 3,910–4,443 ft. The Bureau of Mineral Resources ran a gamma ray log from 0–4,400 ft. Rotary Engineering Company prepared gas and lithological logs from 3,500 ft. to total depth.

The stratigraphic units penetrated in the well were:—

0– 367 ft.	Roma Formation	
367– 478 ft.	" Transition Beds "	Blythesdale Group
478– 702 ft.	Mooga Sandstone	
702– 894 ft.	" Fossil Wood Beds "	
894–1,410 ft.	Gubberamunda Sandstone	
1,410–2,943 ft.	Walloon Coal Measures	
2,943–3,450 ft.	Bundamba Sandstone	
3,450–4,200 ft.	Moolayember Formation	
4,200–4,405 ft.	Pickanjinnie Formation	
4,405–4,728 ft.	Latemore Formation	
4,728–4,775 ft.	Timbury Hills Formation	

The target horizons were:—

3,981–3,999 ft.	" Hospital Hill Sandstone "
4,005–4,010 ft.	" Links Sandstone "
4,195–4,200 ft.	? " Showground Sandstone "
4,231–4,242 ft.	Permian sandstone
4,310–4,314 ft.	Permian sandstone
4,346–4,348 ft.	Permian sandstone

Water bearing horizons were noted in the Bundamba Sandstone and Walloon Coal Measures. Gas shows were obtained in the Pickanjinnie and Moolayember Formations, and three formation tests were run, with the following results:—

3,450–4,015 ft.	Nil
4,189–4,243½ ft.	Gas (5 mcf)
4,249–4,449 ft.	Gas (621 mcf)

The hole was plugged from 4,260–4,360 ft., 3,950–4,050 ft., 3,400–3,500 ft. and 1,500–1,600 ft., and capped and abandoned on 7th September, 1960.

A.A.O. LATEMORE EAST No. 1

This well was located at lat. 26° 35′ 36″ S., long. 149° 5′ 40″ E., about 20 miles east of Roma, to test the eastern portion of the Latemore seismic high. The drilling contractor was Mines Administration Pty. Ltd., and the rig was a National T–32. Rotary table elevation was 1,045 ft., which was 10 ft. above ground-level. The well was spudded in on 17th September, 1960, and reached total depth of 4,724 ft. on 5th October, 1960.

Twelve and one-quarter inch hole was drilled from surface to 215 ft.; 9⅝ in. 36 lb. casing was run to 208 ft. and cemented to surface. Eight and one-half inch hole was drilled to 4,721 ft., and the last 3 ft. to total depth was cored with a 7⅞ in. bit. Other conventional cores were taken between 3,954 ft. and 4,008 ft. Sidewall cores were taken between 4,015 ft. and 4,097 ft. and at 4,330 ft. Schlumberger ran electric logs to total depth and micrologs between 1,600 ft. and 4,338 ft. in five intervals. An automatic gas detector was run from 1,620–4,570 ft.

The well penetrated the following section:—

0– 322 ft.	Roma Formation	
322– 442 ft.	" Transition Beds "	Blythesdale Group
442– 692 ft.	Mooga Sandstone	
692– 874 ft.	" Fossil Wood Beds "	
874–1,457 ft.	Gubberamunda Sandstone	
1,457–2,887 ft.	Walloon Coal Measures	
2,887–3,425 ft.	Bundamba Group	
3,425–4,150 ft.	Moolayember Formation	
4,150–4,411 ft.	Pickanjinnie Formation	
4,411–4,717 ft.	Latemore Formation	
4,717–4,724 ft.	Timbury Hills Formation	

The target horizons were:—

3,969–3,982 ft.	" Hospital Hill Sandstone "
3,990–3,995 ft.	" Links Sandstone "
4,145–4,150 ft.	? " Showground Sandstone "
4,220–4,230 ft.	Permian sandstone
4,295–4,297 ft.	Permian sandstone
4,328–4,332 ft.	Permian sandstone

Gas was met in the Walloon Coal Measures and in the Pickanjinnie Formation. One drill-stem test was run, of the interval 4,204–4,340 ft., to test the three "Permian sandstones"; petroliferous gas flowed at the rate of 197 mcf per day.

The hole was plugged from 4,200–4,350 ft., 3,920–4,050 ft., 3,500–3,600 ft. and 1,500–1,600 ft.: 5½ in. casing was run to 1,393 ft. for completion of the well as an artesian water producer.

A.F.O. No. 1 (COOROORAH)

This well was located at lat. 23° 07′ 30″ S., long. 148° 42′ 40″ E., on an anticline defined by surface geological mapping, gravimetric and seismic methods. The drilling was subsidised by the Commonwealth Government. The rig was a National T–32, and the drilling contractor was Mines Administration Pty. Ltd. Rotary table elevation was 605 ft., 10 ft. above ground level. Drilling began on 25th October, 1959, and total depth of 3,523 ft. was reached on 22nd January, 1960. Twelve and one-quarter inch hole was drilled from surface to 410 ft. and 9⅝ in. 40 lb. casing was run and cemented to surface. Drilling of 8½ in. hole continued to total depth. Twenty cores were cut during the drilling of the well. The hole was logged at various stages by a Schlumberger unit. Electric logs were run from 410 ft. to total depth, section gauge from 410–3,100 ft. and microlog from 410–2,779 ft. A gamma ray log was run from surface to 425 ft.

The following stratigraphic units were penetrated:—

surface–140 ft.	Crocker Formation	Permian
140–1,215 ft.	Maria Formation	
1,215–1,638 ft.	"Upper Siltstone"	
1,638–2,640 ft.	Churchyard Sandstone	
2,640–3,010 ft.	"Lower Siltstone"	
3,010–3,090 ft.	Andesitic tuff	
3,090–3,190 ft.	Breccia	
3,190–3,380 ft.	Andesite	
3,380–3,523 ft.	Basement	

The Crocker Formation consists predominantly of sandstone with minor interbedded mudstone. The Maria Formation consists of sandstone and siltstone in approximately equal proportions, with minor interbedded shale and mudstone, and with a thin coaly section between 150 ft. and 170 ft. The "Upper Siltstone" is composed dominantly of siltstone with some interbedded sandstone. The Churchyard Sandstone is characteristically sandy; it consists of sandstone much of which is extensively recrystallized, with interbedded sandy siltstone throughout the unit. The lithology is strikingly uniform. The "Lower Siltstone" consists of interbedded sandstone and siltstone, the amount of siltstone probably predominating, with minor interbedded mudstone. The section to the base of the "Lower Siltstone" at 3,010 ft. is believed to be Permian in age.

The andesitic tuff (3,010–3,090 ft.) is underlain by breccia consisting of angular fragments of quartzite, sandstone and

mudstone set in a fine-grained matrix of siliceous sandstone or siltstone. This is underlain by holocrystalline andesite. The "basement" was described by the well-site geologists as highly silicified siltstone or quartzite. Later microscopic work makes it seem likely that the section below 3,470 ft. is igneous (spherulitic rhyolite), but the nature of the section above this to the base of the andesite is not certain.

Minor gas bubbling was noted in the mud sheath of core taken between 767 and 777 ft. No oil was noted in any of the cores or cuttings, although slight fluorescence was noted at several places. No indication was of sufficient intensity to warrant formation testing, and the well was plugged and abandoned as a dry hole on 23rd January, 1960.

C.O.L. No. 1 (SPECULATION)

Operations were resumed in April, 1960, and fishing for tools continued until the end of the year. The total depth remained 2,332 ft.

CONORADA OOROONOO No. 1

This well was located at lat. 23° 10′ 50″ S., long. 141° 33′ 09″ E., near the Ooroonoo Channel of the Diamantina River, about 110 miles south-west of Winton. It was drilled as an off-structure stratigraphic test to investigate the nature and thickness of the Mesozoic section and the nature of the underlying formations. The drilling contractor was Mines Administration Pty. Ltd., using a Sullivan 300A rig. Drilling commenced on 20th July, 1960, and total depth of 3,852 ft. was reached on 21st August. Ground elevation was 400 ft. and rotary table elevation 405 ft. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter inch hole was drilled to 210 ft., and 9⅝ in. 40 lb. casing was run to 205 ft. and cemented to surface. Five and three-quarter inch hole was drilled from 210 ft. to total depth.

Twenty-one cores were cut for a total footage of 220 ft., 163½ ft. (or 74 per cent.) being recovered. Electric and gamma ray logs were run by Mines Administration Pty. Ltd. using a Failing Logmaster unit. The electric logs were run from 200–1,786 ft. and from 1,650–3,852 ft. The gamma ray log was run to 2,110 ft.

The following stratigraphic section was reported:—

0–1,010 ft.	Winton Formation
1,010–2,370 ft.	Wilgunya Formation (Roma–Tambo equivalents)
2,370–3,640? ft.	Longsight Sandstone (Blythesdale Group)
3,640?–3,840 ft.	Permo–Triassic? This section consists mainly of coarse and fine sandstones, with red-brown and varicoloured shale, probably unconformable beneath the Longsight Sandstone
3,840–3,852 ft.	Gneissic granite

No oil or gas shows were noted. The reservoirs of the Longsight Sandstone are probably fresh-water bearing

The hole was plugged from 3,025–3,075 ft., 2,300–2,350 ft., 180–230 ft. and from surface to 20 ft., capped and abandoned as a dry hole on 23rd August, 1960.

D.F.S. No. 1 (BETOOTA)

This well was drilled at lat. 25° 42′ 30″ S., long. 140° 49′ 46″ E. to test a large closed anticlinal structure (Betoota Structure) defined by surface geological mapping and seismic methods. The drilling was subsidised by the Commonwealth Government. Surface elevation was 345 ft., and elevation of the rotary table 359 ft. The drilling contractor was Delta Drilling Company, using a National "Ideal" 130 rig. Drilling commenced on 22nd December, 1959, and total depth of 9,824 ft. was reached on 17th April, 1960.

Twenty-six inch hole was drilled from surface to 44 ft., 20in. 94 lb. casing then being run to settling depth 39 ft. and cemented to surface. Seventeen and one-half inch hole was then drilled from 44–1,203 ft., and 13⅜ in. 54½ lb. and 48 lb. casing was run to settling depth 1,203 ft. and cemented to surface. Twelve and one-quarter inch hole was drilled from 1,203 ft. to 4,028 ft. and 9⅝ in. 40 lb. casing was run to settling depth 4,028 ft. and cemented to 2,130 ft. Eight and one-half inch hole was drilled from 4,028 ft. to total depth of 9,824 ft.

Thirty-four cores were cut for a total footage of 365 ft., with core recovery of 79 per cent. Sidewall sampling was carried out between 1,248 ft. and 3,251 ft. and between 4,150 ft. and 5,723 ft. Samples were recovered however, only in 13 cases out of 60. Welex Inc. ran electric, self-potential-resistivity, guard, contact-caliper, gamma ray and dipmeter survey logs.

The strata penetrated were reported as:—

120–1,350 ft.	Winton Formation equivalents	
1,350–2,490 ft.	Tambo Formation equivalents	
2,490–3,245 ft.	Roma Formation equivalents	
3,245–3,451 ft.	"Transition Beds" equivalents	Blythesdale Group
3,451–4,196 ft.	Mooga Sandstone equivalents	
4,196–4,484 ft.	"Fossil Wood Beds" equivalents	
4,484–5,000 ft.	Gubberamunda Sandstone equivalents	
5,000–5,757 ft.	Walloon Coal Measures equivalents	
5,757–9,824 ft.	Palaeozoic rocks	

Below a marked angular unconformity at 5,757 ft., the strata consisted entirely of steeply dipping conglomerate and conglomeratic or lithic sandstone, sheared at a high angle, with pebbles elongated along the line of shear.

Showings of hydrocarbons (yellow fluorescence and gas) were noted between 4,400 ft. and 5,757 ft. Formation tests were carried out over the intervals, 3,542–3,563 ft. (water aquifer in Betoota Artesian Well), 4,424–4,463 ft., 4,779–4,801 ft., 5,388–5,420 ft. and 6,910-7,036 ft. The only production was water from the intervals 3,542–3,563 ft. and 4,779–4,801 ft., and drilling mud and watery mud from the others.

The well was plugged from 3,913–4,213 ft. and from 330–530 ft., capped and abandoned as a dry hole on 18th April, 1960.

MAGELLAN CORFIELD No. 1

This well was located at Corfield, lat. 21° 42′ 40″ S., long. 143° 22′ 30″ E., 56 miles north-east of Winton. It was drilled to 2,630 ft. as a water bore by Winton Shire Council, and deepened to 4,507 ft. by Magellan Petroleum Corp. for stratigraphic information about the pre-Mesozoic section. The deepening was subsidised by the Commonwealth Government.

The driller was W. L. Sides and Son Pty. Ltd., and the rig a Cardwell Model HL. Surface elevation was 842 ft. and rotary table elevation was 847 ft. Drilling of 5½ in. hole below 6 in. casing set to 2,726 ft., began on 21st May, 1960. Total depth of 4,507 ft. was reached on 15th June, 1960. Five cores were cut, at 2,892–2,902 ft., 3,389–3,399 ft., 3,930–3,940 ft., 4,262–4,276 ft. and 4,504–4,507 ft. Electric logs were run by Mines Administration Pty. Ltd. with a Failing Logmaster on 20th June, 1960; self-potential and single-point resistivity logs were run from 2,707–4,500 ft., and a gamma ray log from surface to 2,390 ft.

Samples from surface to 2,630 ft. were examined at the Geological Survey of Queensland.

The samples from 2,630–4,507 ft. were logged by the Company. The following lithological distinctions have been made:—

0– 300 ft.	Sandstone, siltstone and shale, some carbonaceous and some calcareous.
300–2,650 ft.	Mainly mudstone, most calcareous with some calcareous and argillaceous sandstone and some limestone, with *Inoceramus* recorded from 1,300–2,620 ft. This occurrence suggests a Tambo age for the fossiliferous section. P. R. Evans (BMR) on palynological evidence considers cuttings from 2,630–2,640 ft. to be Aptian in age.

2,650–2,920 ft.	Sandstone (fine and medium grained) siltstone, shale and coal.
2,920–4,100 ft.	Medium grained sandstone with shale and coal between 3,310 ft. and 3,470 ft., and fine grained sandstone and shale between 3,800 ft. and 4,100 ft.
4,100–4,488 ft.	Sandstone, siltstone, shale and coal
4,488–4,507 ft.	Granite.

Evans has made the following correlations in the lower section of the bore:

2,892–2,902 ft.	Lower Middle Jurassic	} Bundamba?
3,389–3,399 ft.	Lower Jurassic	
4,262–4,276 ft.	Lower? Triassic	

No hydrocarbon shows were encountered. The section penetrated many sandstones with high porosity and permeability, and these were all saturated with fresh water.

No marine rocks were encountered, and the hole proved that marine Cambrian and Ordovician rocks of the Georgina Basin do not extend as far eastwards as Corfield. The northward development of mid-Palaeozoic continental clastic sediments is also limited.

The hole was completed as a water bore for the Winton Shire Council.

QUEENSLAND AMERICAN THE OVERFLOW No. 1

This well was located at lat. 27° 48′ 30″ S., long. 152° 51′ 4″ E., about 10 miles west-north-west of Beaudesert. The well was drilled to determine the stratigraphic succession and to test the oil and gas prospects of the Juberra (or South Moreton) Anticline, a large faulted structure defined by surface geological mapping.

The drilling contractor was Mines Administration Pty. Ltd., using a National 55 drilling rig. Ground elevation was 183 ft., and rotary table elevation was 194 ft. Drilling commenced on 8th April, 1960, and total depth of 2,993 ft. was reached on 16th May. The work was subsidised by the Commonwealth Government.

Twelve and one-half inch hole was drilled from surface to 214 ft., the top 185 ft. afterwards being reamed to 17½ in. Thirteen and three-eighths inch 54 lb. casing was inserted to 174 ft. and cemented to surface. Eight and one-half inch hole was drilled from 214 ft. to 2,990 ft. and 7⅞ in. hole from 2,990 ft. to total depth.

Sixteen cores were taken, nine in the upper sedimentary section and seven in the lower volcanic section. Schlumberger ran electric logs from 175–1,755 ft. and 1,655–2,931 ft., and microlog from 176–1,753 ft. Rotary Engineering Co. operated an automatic gas detector.

The following stratigraphic section was reported:—

0– 310 ft.	Bundamba Sandstone
310– 630 ft.	?Ipswich Coal Measures
630–1,605 ft.	Ipswich Coal Measures
1,605–2,993 ft.	Volcanics, largely andesite and andesitic tuff with some rhyolite and trachyte towards the bottom

The sediments below 630 ft. showed fluorescence and gave positive cuts with carbon tetrachloride. Some cores had a distinct oily smell. These "shows" are probably distillation products from coal seams coked by igneous intrusions. Gas shows recorded were considered to come from coal seams.

The well was plugged with 50 ft. of cement set at the casing shoe and with cement set in the top 20 ft. of the casing, the casing being left filled with mud. The well was capped and abandoned as a dry hole on 18th May, 1960.

SMART OIL HARKAWAY SCOUT No. 1

This scout bore was drilled at 26° 26′ S., 142° 59′ E., about 80 miles west-north-west of Quilpie; it is on the eastern flank of the Harkaway Anticline which was defined by seismic methods. The drilling contractor was J. R. Robinson of Quilpie, using a percussion plant. Ground elevation at the site was 685 ft. Drilling was commenced on 6th January, 1960, and finished on 5th May, at total depth of 1,850 ft.

Ten inch hole was drilled to 40 ft., and 6 in. casing was run and cemented to the surface. Thereafter 5 in. hole was drilled.

Sludge samples from the hole were logged at the Geological Survey of Queensland. These indicated that the sequence penetrated was rather uniform lithologically, consisting mainly of mudstone and siltstone, with some sandstone, coal and carbonaceous shale. The whole section, then, may have been Winton Formation, with perhaps some Tertiary sediments at the surface.

Gas shows were recorded at 635–655 ft., 771 ft., 927–935 ft., 970 ft., 1,375 ft., and 1,850 ft. Analyses revealed that these were hydrogen-methane gases, with a high proportion of nitrogen.

SMART OIL ORIENT SCOUT No. 1

This bore was located at lat. 27° 40′S., long. 143° 9′E., 53·1 miles by road north-west of Thargomindah. It was drilled to investigate a seismic high (the Chesson Anticline) determined by seismic methods. The drilling contractor was J. R. Robinson, using a small percussion plant. Ground elevation was 446 ft. Drilling began on 23rd May, 1960, and reached a depth of 1,658 ft. (reported as the limit of the plant) on 8th November.

Eight inch hole was drilled from surface to 60 ft., and 6 in. casing was set and cemented to the surface. Five inch hole was then drilled. Cores were cut at 1,035 ft., 1,300 ft., 1,400 ft., 1,445 ft., 1,450 ft., and 1,500 ft.

Sludge samples from the bore were examined at the Geological Survey of Queensland. The succession was:

0– 55 ft.	Sandstone
55– 220 ft.	Mainly siltstone, with some mudstone and limestone below 150 ft.
220–1,658 ft.	Mainly mudstone and calcareous mudstone with some sandstone, siltstone and limestone

Palaeontological work indicated Tambo fossils at 285 ft., and Roma fossils from 1,300 ft.

A showing of gas was met at 1,075 ft. Analysis revealed this to consist mainly of inerts and hydrogen. Several cores were tested by the Government Analyst for the presence of mineral oil, with negative results. Water flows were met at 179–181 ft. and 960 ft.

The Company has stated that it proposes to deepen the bore with a more powerful plant.

STANDARD GAS ASPLEY SCOUT No. 1

This bore was drilled at Aspley, about eight miles north-west of Brisbane, on resubdivision 2, subdivision 1, por. 152, parish of Nundah (2.9 chains bearing 310° from the corner of Graham Road and Hawbridge Street). It was drilled on a divined site near a mud "volcano" believed to be caused by hydrostatic pressure. Ground elevation is approximately 100 ft. The drilling contractor was S. H. Scells, a water driller, using a small percussion plant. Work was started on 28th March, 1960, and finished on 25th October at total depth 970 ft.

Six inch hole was drilled from surface to 500 ft., and 5 in. hole from 500–970 ft. The hole is cased with 6 in. casing to 500 ft. and 5 in. casing to 700 ft.

Sludge samples obtained from the bore were logged at the Geological Survey of Queensland, and the following stratigraphic sequence was determined:—

0– 744 ft.	South Pine Formation
744– 970 ft.	Basalt

The South Pine Formation consists of mudstone and calcareous mudstone, with numerous bands of oil shale. Ostracods indicating a Tertiary age occur. A composite sample of the oil shale yielded five gallons of oil per ton by destructive distillation. The basalt is fresh towards the top, but is extensively weathered below 805 ft.

Water was encountered at 14 ft., 28 ft., 57½ ft., 62 ft., 472 ft. (salty) and at 806 ft. Gas was recorded at 831 ft.

The casing was left in position, and the hole capped; the Company stated that it hoped later to deepen the hole.

STANDARD GAS CRIBB ISLAND No. 1

This well was drilled at Cribb Island, 10 miles north-east of Brisbane, on por. 283, parish of Toombul, one mile south of the Cribb Island State School. The site was selected by divination on the flank of a gravity high. The ground elevation was a few feet above high water mark. The drilling contractor was Godfrey Bros., using a Hydromaster 750 percussion rig. The well was spudded in on 23rd February, 1960; shortly after, it was abandoned at 55 ft. due to drilling difficulties, and the plant moved to a new site 15 ft. away. A depth of 1,420 ft. was reached on 31st December, 1960.

The hole was cased with 10½ in. casing set to 4 ft., 9½ in. casing set to 28 ft., 8 in. casing set to 172 ft., 6 in. casing set to 673 ft. and 5 in. casing set to 1,150 ft.

Lithological logging of sludge samples was carried out by the Geological Survey of Queensland. The following stratigraphic units were distinguished:—

0– 120 ft.	Mud, sand, gravel (Quaternary)
120– 340 ft.	Basalt (Tertiary?)
340– 640? ft.	Sandstone, mudstone, some basalt (Tertiary?)
640?–1,420 ft.	Ipswich Coal Measures equivalents

Gas was met in the coal measure sediments below 820 ft. and was recorded as far as 1,420 ft. Analysis revealed this to be essentially methane. Oily sludges giving a bluish fluorescence were recovered in several places. These are considered to result from contamination by drilling lubricants.

Salt water was met in the unconsolidated sediments above the basalt. Fresh (but alkaline) water-bearing horizons were met at 367–376 ft. and at 690–710 ft.

Drilling is continuing.

UNION–KERN–A.O.G. CABAWIN No. 1

This well was drilled for Union Oil Development Corp., Kern County Land Co. and Australian Oil and Gas Corp. Ltd. in Authority to Prospect 57P. It was located at lat. 27° 28′ 16″ S., long. 150 ° 11′ 19″ E., about 20 miles south-west of Tara, to test a structural high, defined principally by seismic methods.

The drilling contractor was Oil Drilling and Exploration Ltd. of Sydney, using a National 80B drilling rig. The well was spudded in on 6th October, 1960, and had reached a depth of 9,952 ft. by 31st December. Ground elevation was 951·4 ft. and rotary table elevation 966·9 ft. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter inch hole was drilled to 562 ft., and 8¾ in. hole from 562–585 ft. The hole was then reamed to 17½ in. from surface to 585 ft. and 17½ in. hole was drilled from 585–620 ft. Thirteen and three-eighths inch 48 lb. casing was run and set to 591 ft. and cemented to the surface. Eight and three-quarter inch hole was drilled below 620 ft.

Thirty-two conventional cores and seventy-one sidewall cores were taken. Schlumberger ran electric logs from 591–9,945 ft. (six runs), and micrologs from 591–7,915 ft. (five runs). Rotary Engineering Company maintained an automatic gas detector.

The following stratigraphic sequence was reported:—

0–2,864 ft.	Roma Formation
2,864–4,200 ft.	Blythesdale Formation
4,200–5,444 ft.	Walloon Coal Measures
5,444–7,640 ft.	Bundamba Formation
7,640–9,860 ft.	Cabawin Formation (Permian–Triassic)
9,860–9,952+ ft.	Kianga Formation (Permian)

Numerous gas shows were recorded in the upper part of the hole, in association with coal seams. Gas shows were also recorded at 6,220–6,294 ft., 6,750–6,767 ft. (good show and fluorescent cut), 7,386 ft. and 7,840 ft. Fluorescence, oil staining and a kerosene odour were noted below 9,912 ft. A gas blow out occurred at 9,935 ft.

Four drill stem tests were conducted, the results of which are summarized below:—

6,728-6,776 ft.	Water, gassy water
7,388–7,406 ft.	Water, gassy water
7,822–7,915 ft. 7,834–7,916 ft.	Nil (packers failed)

S. G. Reid, Government Printer, Brisbane

QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

Second Supplement to
Geological Survey Publication No. 299

"OCCURRENCE OF PETROLEUM AND NATURAL GAS IN QUEENSLAND"
1961

PETROLEUM EXPLORATION IN QUEENSLAND DURING 1961

PETROLEUM PROSPECTING
By I. W. MORLEY, State Mining Engineer

DRILLING RESULTS
By I. G. SANKER, Geologist

APPENDIX

CORRELATION OF THE MESOZOIC STRATA OF THE SURAT BASIN
By R. J. ALLEN, Geologist

BRISBANE
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1962

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PETROLEUM EXPLORATION IN QUEENSLAND DURING 1961

PREFACE

Publication No. 299 of the Geological Survey of Queensland—"Occurrence of Petroleum and Natural Gas in Queensland"—dealt with the search for petroleum in Queensland to the end of 1959. To keep this publication up to date, it was decided to issue as a supplement each year, a reprint of the section of the Annual Report of the Department of Development and Mines relating to petroleum exploration. This reprint is the second supplement.

PETROLEUM PROSPECTING

By I. W. MORLEY, State Mining Engineer

This section is divided into parts as follows:—

1. Introduction.
2. Oil Prospecting Titles held.
3. Exploration Activities (General).
4. Exploration Drilling.
5. Employment and Accidents.
6. Legislation and Instructions to Operators.
7. General Survey of the Industry.

PART 1—INTRODUCTION

As a result of the recent encouraging results of exploration this section is assuming greater importance, and further attempts have been made to improve the layout, chiefly by grouping together text and tables which are related to each other.

It is to be noted that Part 4, "Exploration Drilling," is relatively brief. Technical data relating to each well drilled, and geological information obtained, appears in a separate section of this Supplement.

PART 2—OIL PROSPECTING TITLES HELD

In the 1960 Annual Report (pages 40 and 41) oil prospecting titles held as at 31st December, 1960, were shown. Summarised, these comprised seven Prospecting Petroleum Permits totalling 1,288 square miles, and twenty-four Authorities to Prospect totalling 807,540 square miles. As at 31st December, 1961, five Prospecting Petroleum Permits totalling 900 square miles, and twenty-five Authorities to Prospect totalling 775,530 square miles were held, while several relinquished areas were under application for Authorities to Prospect.

Figure 1 shows the location of oil prospecting titles and applications as at 31st December, 1961. Table A sets out their status as at that date while Table B shows titles which were relinquished during the year.

As at 31st December, 1961, the entire area of the State was either held under Prospecting Titles or under application for such title.

PART 3—EXPLORATION ACTIVITIES (GENERAL)

The details on p. 6 of work done in terms of surface geology, geophysical surveys, exploration drilling and other forms of prospecting during 1961 have been obtained from titleholders, personal enquiry and observation. In addition work done by Government agencies is described.

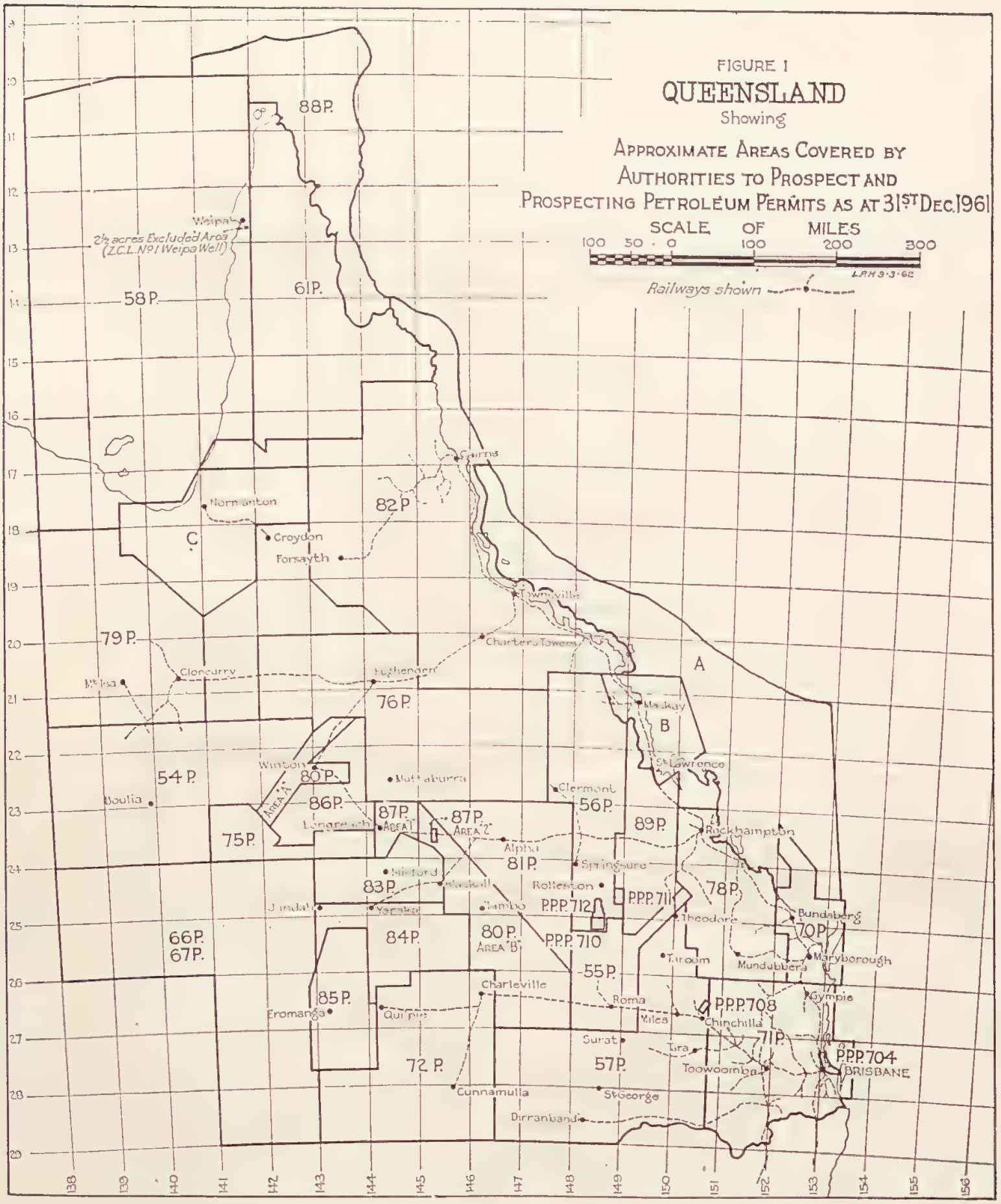


FIGURE 1
QUEENSLAND
Showing
APPROXIMATE AREAS COVERED BY AUTHORITIES TO PROSPECT AND PROSPECTING PETROLEUM PERMITS AS AT 31ST DEC. 1961
SCALE OF MILES
100 50 0 100 200 300
L.P.H. 9-3-62
Railways shown
88P.
Weipa
2½ acres Excluded Area (Z.C.L. No 1 Weipa Well)
58P.
61P.
82P
Normanton
Croydon
Forsayth
Cairns
Townsville
Charters Towers
79P.
Cloncurry
Mt Isa
Hughenden
76P.
A
Mackay
B
St Lawrence
54P.
Winton
80P.
Boulia
Area "A"
86P.
87P.
Area "A"
87P.
Area "2"
Longreach
Muttaburra
Clermont
56P.
89P.
Rockhampton
75P.
Alpha
81P.
Springsure
Isisford
83P.
Blackall
Rolleston
78P.
Jundah
Yaraka
Tambo
PPP 712
PPP 711
Theodore
Bundaberg
70P.
66P.
67P.
84P.
80P.
Area "B"
PPP 710
Taroom
Mundubbera
Maryborough
55P.
Charleville
Roma
Gympie
85P.
Eromanga
Quilpie
PPP 708
Chinchilla
Miles
Surat
Tara
71P.
PPP 704
BRISBANE
Toowoomba
72P.
57P.
Cunnamulla
St George
Dirranbandi
138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156

Table A

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
	Sq. Miles			
		PROSPECTING PETROLEUM PERMITS		
P.P.P. 704	200	Standard Gas Pty. Ltd., L. G. Neill, Managing Director, 307 Queen Street, Brisbane	Brisbane	Drilling, temporarily suspended
P.P.P. 708	100	Condamine Oil Ltd., R. Swinton, Managing Director, Box 1038N, G.P.O., Brisbane ; J. Kooy, Driller in Charge, Auburn Road, Chinchilla	North of Chinchilla ..	Fishing completed, temporarily suspended
P.P.P. 710	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South of Springsure ..	Suspended
P.P.P. 711	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South-East of Springsure	Suspended
P.P.P. 712	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South of Springsure ..	Suspended
Total ..	900	Square Miles.		
		AUTHORITIES TO PROSPECT		
54P* ..	43,000	The Papuan Apinaipi Petroleum Company Limited, B. W. Graham, Chairman and Managing Director, Box 4991, G.P.O., Sydney. D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	Boulia	Geological and Geophysical Investigations
55P* ..	11,570 Amalgamated	Associated Australian Oilfields No Liability, E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne ; D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	Roma–Theodore	Geological and Geophysical Investigations and Drilling
56P* ..	21,870	Associated Freney Oil Fields No Liability, E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne ; D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	Mount Morgan–Clermont–Mackay	
57P ..	43,000	Australian Oil and Gas Corporation Limited with whom are associated in this area Union Oil Development Corporation, and Kern County Land Company. A.O.G.: T. W. H. Dee, Managing Director, Box 5048, G.P.O., Sydney ; Professor E. A. Rudd, Geological Consultant, University of Adelaide, Adelaide, South Australia. Operator—Union : D. Tower, President, Union Oil Centre, Los Angeles, California, U.S.A.; D. Graves, Resident Manager, Box 5048, G.P.O., Sydney; D. Pyle, Field Superintendent, 216–220 Margaret Street, Toowoomba.	St. George–Miles ..	Geological and Geophysical Investigations and Drilling
58P ..	137,000	Santos Limited (50 per cent.) and Delhi Australian Petroleum Ltd. (50 per cent.). Santos : J. G. Bonython, Chairman, Mutual Life Chambers, 44 Grenfell Street, Adelaide, South Australia. Geo-Surveys of Australia Pty. Ltd. (R. C. Sprigg, Managing Director). Geological Consultants, Box 1479L, G.P.O., Adelaide, South Australia. Delhi : W. Clifford Smith, Vice President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837P, G.P.O., Adelaide, South Australia. Operator—Delhi	Gulf of Carpentaria ..	Suspended subsequent to drilling
61P ..	45,900	Plymouth Oil Company: G. H. Fisher, Vice President, First City National Bank Building, Houston 2, Texas, U.S.A., ; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cape York Peninsula ..	Suspended
66P ..	33,800 Checkerboarded and Interrelated	Santos Limited : J. Bonython, Chairman, Mutual Life Chambers, 44 Grenfell Street, Adelaide, South Australia. Geo-Surveys of Australia Pty. Ltd. (R. C. Sprigg, Managing Director). Geological Consultants, Box 1479L, G.P.O., Adelaide, South Australia	Haddon Corner, Qld.–S. A. Border	Geological and Geophysical Investigations
67P ..	33,800	Delhi Australian Petroleum Ltd.: W. Clifford Smith, Vice President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837P, G.P.O., Adelaide, South Australia. Operator—Delhi		

Table A—*continued*

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
	Sq. Miles			
		AUTHORITIES TO PROSPECT—*continued*		
70P ..	10,000	Pacific American Oil Company: Gene Goff, President, 305 Pan American Building, Tulsa 3, Oklahoma, U.S.A.; C. W. Siller, Vice President, Box 1555V, G.P.O., Brisbane	Maryborough–Bundaberg	Suspended subsequent to Geological and Geophysical Investigations
71P ..	29,500	Queensland American Oil Company (50 per cent.) and Sunray Mid-Continent Oil Company (25 per cent.) and Phillips Petroleum Company (25 per cent.). Operator—Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 124, P.O., North Quay, Brisbane	Gympie–Brisbane–Toowoomba	Geological and Geophysical Investigations
72P ..	35,000	Sunray Mid-Continent Oil Company (50 per cent.) and Phillips Petroleum Company (50 per cent.). Operator—Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 124, P.O., North Quay, Brisbane	Charleville	Geological and Geophysical Investigations
75P ..	8,300	Amerada Petroleum Corporation of Australia Limited, Continental Oil Company of Australia Limited and Ohio Oil International of Australia Ltd. (Equal shares). Operator—Conorada Petroleum Corporation: B. V. Uhl, President, 630 Fifth Avenue, New York, U.S.A.; I. McPhee, Resident Geologist, Box 465F, G.P.O., Brisbane	West of Longreach ..	Geological and Geophysical Investigations
76P ..	48,000	Artesian Basin Oil Company Pty. Ltd.; Gene Goff, Chairman, 305 Pan American Building, Tulsa 3, Oklahoma, U.S.A.; C. W. Siller, Managing Director, Box 1555V, G.P.O., Brisbane	Hughenden	Geological Investigations
78P ..	19,400	Nortex Australian Oils Ltd.; J. R. Wendover, President, 1900 Life Building, Dallas 2, Texas, U.S.A.; A. C. Freeleagus, Solicitor, Box 1129P, G.P.O., Brisbane	Rockhampton–Mundubbera	Suspended
79P ..	40,000	Australamerica Corporation: W. S. Wallis, President, Box 394–C, Spring Valley Road, Dallas 30, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cloncurry–Mount Isa ..	Suspended
80P	Area A 5,000	Magellan Petroleum Corporation (75 per cent.) and Central Queensland Petroleum Coy. Pty. Ltd. (25 per cent.). Magellan: B. W. Heath, President, 103 East 37 Street, New York, U.S.A.; H. I. Harris, Chief Geologist, Australia, Box 455F, G.P.O., Brisbane	Winton	Suspended
	Area B 18,000	Central Queensland: R. F. G. Wilson, Agent, Box 1555V, G.P.O., Brisbane. Operator—Magellan. Magellan Petroleum Corporation: B. W. Heath, President, 103 East 37 Street, New York, U.S.A.; H. I. Harris, Chief Geologist, Australia, Box 455F, G.P.O., Brisbane	Tambo	
81P ..	19,500	Oil Development N.L.: H. B. Borwick, Managing Director, 11th Floor, 100 Collins Street, Melbourne. Geo-Surveys of Australia Pty. Ltd.: R. C. Sprigg, Managing Director; Geological Consultants, Box 1479L, G.P.O., Adelaide; L. W. Doggett, Agent, Box 281D, G.P.O., Brisbane	Alpha	Geological and Geophysical Investigations
82P ..	82,000	Triton of Australia Ltd.; W. Moss, President, care of North Star Oil Corporation, 1007 Midland Savings Building, Midland, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cairns	Suspended
83P ..	9,300	Amerada Petroleum Corporation of Australia Limited, Continental Oil Company of Australia Limited, Ohio Oil International of Australia Ltd. (Equal shares). Operator—Conorada Petroleum Corporation: B. V. Uhl, President, 630 Fifth Avenue, New York, U.S.A.; I. McPhee, Resident Geologist, Box 465F, G.P.O., Brisbane	Isisford	Geological and Geophysical Investigations

Table A—*continued*

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
	Sq. Miles			
		AUTHORITIES TO PROSPECT—*continued*		
84P ..	13,500	Sunray Mid-Continental Oil Company (50 per cent.) and Phillips Petroleum Company (50 per cent.). Operator—Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager Australian Operations, Box 124, P.O., North Quay, Brisbane	Yaraka	Geological and Geophysical Investigations and Drilling
85P ..	11,900	L. H. Smart Oil Exploration Co. Limited: L. H. Smart, Chairman, Box 2670, G.P.O., Sydney; R. C. Sprigg, Geological Consultant, Box 1479L, G.P.O., Adelaide, South Australia	Eromanga	Drilling
86P* ..	9,300	Associated Australian Oilfields No Liability: E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Chief Geologist, Box 880L, G.P.O., Brisbane	West of Longreach ..	Geological and Geophysical Investigations
87P ..	Area No. 1 2,700 Area No. 2 90	Longreach Oil Limited: W. McD. Royle, Managing Director, Box 775, G.P.O., Sydney; W. D. Mott, Consulting Geologist, Astor Court, corner Wharf and Leichhardt Streets, Brisbane	Ilfracombe	Geological and Geophysical Investigations
88P ..	31,000	Gulf Interstate Overseas Ltd.: Hy. Bird, President, 1125 Brazos Street, Houston, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Torres Strait	Suspended
89P ..	13,100	Ohio Oil International of Australia Ltd. and Continental Oil Company of Australia Limited (Equal shares). Operator—Ohio: G. R. Schoonmaker, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Baralaba–Duaringa–St. Lawrence	Suspended
Total Area	775,530	Square Miles.		

* In these areas 54P, 55P, 56P and 86P Associated Australian Oilfields No Liability, Associated Freney Oil Fields No Liability, The Papuan Apinaipi Petroleum Company Limited, Interstate Oil Ltd., Sleigh Exploration N.L., and Associated Continental Petroleum N.L. are jointly associated. In respect of 54P, Phillips–Sunray (for details of Company names and Principal Officers see 72P and 84P) have an option over 50 per cent. of this area on a checkerboard basis and in pursuance of this option Phillips are the present operators.

In respect of 55P, 56P, and 86P the operators are subsidiary companies, Petroleum Exploration Company (Petexco) in association with Mines Administration Pty. Ltd. E. N. Avery, Managing Director, D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane.

Table B

No.	Holder	Locality	Remarks
		Prospecting Petroleum Permits	
P.P.P. 697	Planet Exploration Company Pty. Ltd.	South-East of Springsure ..	Conditionally surrendered to become P.P.P. 711
P.P.P. 705	Longreach Oil Ltd.	Barcaldine and Ilfracombe ..	Surrendered and merged in 87P
P.P.P. 706	Planet Exploration Company Pty. Ltd.	South of Springsure	Conditionally surrendered to become P.P.P. 712
P.P.P. 707	Planet Exploration Company Pty. Ltd.	South of Springsure	Conditionally surrendered to become P.P.P. 710
P.P.P. 709	W. C. and H. J. Walz	West of Mackay	Expired
		Authorities to Prospect	
60P ..	L. H. Smart Oil Exploration Co. Limited	Eromanga	Surrendered and merged in 84P (part) and 85P (balance)
64P ..	Carpentaria Oils Pty. Ltd.	Julia Creek–Ilfracombe	Surrendered
65P ..	Associated Australian Oilfields N.L. ..	Normanton	Surrendered
77P ..	Reef Oil Company Pty. Ltd.	Mackay	Surrendered

Prospecting Petroleum Permits

P.P.P. 697.—Surrendered. Now P.P.P. 711 (see below).

P.P.P. 704.—Standard Gas Cribb Island No. 1 well deepened to 2,001 ft.

P.P.P. 705.—Surrendered and merged into 87P.

P.P.P. 706.—Surrendered. Now P.P.P. 712 (see below).

P.P.P. 707.—Surrendered. Now P.P.P. 710 (see below).

P.P.P. 708.—Fishing operations to recover lost tools in the well C.O.L. Speculation No. 1 were successfully completed in September. Modifications to plant and well head equipment are in hand. The well was not deepened during the year.

P.P.P. 709.—No field work was carried out on this permit which has now expired.

P.P.P. 710.—No field work was carried out on this permit but consulting geologists were employed to review the prospects of the area.

P.P.P. 711.—No field work was carried out on this permit but consulting geologists were employed to review the prospects of the area.

P.P.P. 712.—No field work was carried out on this permit but consulting geologists were employed to review the prospects of the area.

Total area held under Prospecting Petroleum Permits at December 31st, 1961: 900 square miles.

Authorities to Prospect

54P.—A geological party was engaged for a short period field checking photogeological mapping. A short gravity survey was undertaken, also 6 party months' seismic work covering 196 square miles of subsurface contouring.

55P and 56P.—Amalgamated Authorities (see Table A). The eastern half of 56P and part of the north-eastern arm of 55P have been severed and amalgamated to form a new Authority to Prospect (see 89P). A very active exploration programme has been pursued on the remainder of the amalgamated 55P/56P authorities, chiefly centred in the Roma–Injune areas of 55P and consisted of seismic surveys and exploration drilling. Over 4,000 square miles have been covered by subsurface contours in 21 party months' seismic work, resulting in a number of targets for exploration drilling. Four wells to a total footage of 21,001 ft. were completed, namely A.A.O. Pickanjinnie No. 2, A.A.O. Combarngo No. 1, A.A.O. Winnathoola No. 1 and A.A.O. Glentulloch No. 1. Gas or oil shows were encountered in all of these wells, and the lastnamed, Glentulloch No. 1, has been established as a potential gas well.

57P.—This year has again seen a very vigorous exploration programme pursued, which included drilling to total depth (12,035 ft.) the discovery well U.K.–A.O.G. Cabawin No. 1, the dry hole U.K.-A.O.G. Cabawin East No. 1, and at the end of the year, the potential producer U.K.–A.O.G. Moonie No. 1. Surveys carried out included geological, aerial magnetometric, and seismic. Geological work consisted of surface (mapping) and subsurface (well) in addition to special basin studies and seismic interpretation. Geophysical work consisted of some 8 party months' aerial magnetometric, covering some 25,000 square miles, and 17 party months' seismic, covering some 6,000 square miles of subsurface contouring, chiefly in the south-eastern portion of the Authority. Two new wells, Cabawin East No. 1 and Moonie No. 1 were drilled, which, together with 2,083 ft. drilled this year in Cabawin No. 1 brings the total footage drilled on this Authority to 20,280 ft. for 1961. At the year's end the well Moonie No. 1 was closed-in pending sustained production tests early in 1962.

58P.—Work on this Authority was confined to the drilling of two test wells on Mornington Island (Wellesley Group) both being completed, plugged and abandoned as dry holes. Total footage drilled was 5,764 ft.

60P.—This Authority was surrendered during the year and merged into 84P and 85P.

61P.—Other than a short geological reconnaissance of some 10 days' duration, no exploration work has been carried out.

64P.—No work performed and the title surrendered.

65P.—No work performed and the title surrendered.

66P and 67P.—Checkerboarded and interrelated Authorities (see Table A). Work on these Authorities comprised geological and geophysical surveys (aerial magnetometric and seismic). Geological surveys included reconnaissance of pre-Mesozoic rocks in Central Queensland and New South Wales, and totalled some 8 party months; 21,500 square miles were covered by aerial magnetometric surveys, and 1,880 square miles of subsurface contours resulted from seismic surveys, both of which were carried out in the southern part of the Authorities. An electric log was, in addition, run in the Birdsville town bore.

70P.—Seismic work consisting of 1½ party months, covering 43 square miles of subsurface contours, was performed on this area.

71P.—Work carried out comprised 1 month's photogeological interpretation covering some 2,500 square miles, and some 4½ party months' seismic survey, resulting in approximately 620 square miles of subsurface contouring.

72P.—Work on this Authority comprised in all 5½ party months' seismic work. Some 5,000 square miles of subsurface contouring resulted from this survey.

75P.—Both seismic reflection and seismic refraction surveys of a reconnaissance nature were carried out. Altogether some 4¾ party months' field work was involved and resulted in approximately 725 square miles of subsurface contours drawn from the reflection survey. Some photogeology was also carried out.

76P.—Work consisting of 8 party months' geological surveys was performed on this Authority.

77P.—A geological survey of some 6 party months was carried out. The Authority was surrendered in November.

78P.—No field work was carried out on this Authority during the year. Available geological data was reviewed and a report compiled by a consultant.

79P.—Some office research was carried out.

80P.—No work was carried out on this Authority during the year.

81P.—Work carried out comprised 2½ party months' seismic survey. Some 200 square miles of subsurface contours resulted from the survey.

82P.—One party month's geological reconnaissance was carried out on this area. Office studies included photogeology and regional geology, as well as local geological appraisals of sedimentary basins.

83P.—Two party months' geological surveys were completed also 1½ party months' seismic surveys extending over 68½ miles of subsurface section.

84P.—This Authority has been subjected to a vigorous exploration programme of geological, geophysical and drilling activities. A short geological stratigraphical reconnaissance of one party month's duration was made, and a total of 27½ party months' seismic work which resulted in a total of 11,000 square miles being covered by subsurface contours. Two wells P.–S. Buckabie No. 1 and P.–S. Cothalow No. 1 were drilled and completed as dry holes and one well P.–S. Etonvale No. 1 was drilling at 8,542 ft. at the end of the year. Total footage drilled on this Authority during the year was 23,637 ft.

85P.—Some 6 party months' gravity work has been carried out, the well Orient No. 1 was deepened to 3,200 ft. and the well Orient No. 2 drilled to 2,130 ft.

86P.—Three party months' seismic work were completed covering 300 sq. miles of subsurface contouring.

87P.—Office research work included the examination of aerial photographs, compilation work, and correlation of water bore data. In the field, 1 seismic party month's geophysical work was carried out covering some 80 square miles subsurface contours.

88P.—A study of available data has been carried out and a geological reconnaissance trip was made over the area.

89P.—Authority commenced 1st September, 1961. No field work carried out in 1961.

Total area held under Authorities to Prospect at 31st December, 1961: 775,530 square miles. Applications for Authorities to Prospect have been received for areas shown as A, B and C on Figure 1.

Regional Geological Surveys

The Bureau of Mineral Resources in conjunction with the Geological Survey of Queensland again undertook a programme of regional mapping in Queensland. Three parties were engaged on this work, two of which continued investigations of the Bowen Basin and the third in the Artesian Basin.

Geological Survey of Queensland geologists were attached to the two Bowen Basin parties, one of which spent some 12 geologist months mapping the Emerald 4-mile Sheet, and the other some 16 geologist months in the area of the Bowen and Mackay Sheets.

The third party, exclusively Bureau of Mineral Resources, spent some 8 geologist months mapping in the areas covered by the Mackunda, Mackinlay and Julia Creek 4-mile sheets.

Regional Geophysical Surveys

Regional geophysical surveys conducted in Queensland by the Bureau of Mineral Resources comprised gravity surveys, airborne magnetometer and scintillograph surveys, seismic surveys and water bore logging.

Gravity work included surveys of a reconnaissance nature conducted by helicopter in the far south-west (Birdsville) area of the State. Some 50,000 square miles were covered by this survey.

Line traverses were also run between Blackall and Quilpie. and in the St. George–Goondiwindi area. (See Table D.)

Airborne magnetometer surveys covered the Clermont, Emerald and Duaringa 4-mile sheets, and included a scintillograph survey. Altogether some 11,300 line miles were flown on these surveys. In addition, two route traverses were flown, namely Melbourne–Rockhampton and Emerald–Brisbane via Roma and Surat, some 950 miles being traversed in Queensland on this survey. (See Table E.)

The seismic programme carried out by the Bureau of Mineral Resources comprised regional surveys in the Surat Basin (Goondiwindi–St. George area), in the Undilla Basin (east of Camooweal), and in the Eromanga Basin (Tambo area). Altogether 8 party months were spent on these surveys. (See Table F.)

These surveys have been of great value in providing leads to structural trends in the areas covered.

The water bore logging programme conducted by the Bureau of Mineral Resources is a continuation of the project commenced in 1960 having as its objective the correlation of the upper Mesozoic section of the Great Artesian Basin, and of extending the knowledge of aquifers. The gamma ray logging of one dry oil well, A.A.O. Combarngo No. 1 is included in the table. The original project was conceived and sponsored jointly by the Qupex Group, the Irrigation and Water Supply Commission, the Bureau of Mineral Resources and the Department of Development and Mines, and is an excellent example of co-operative effort. Good correlation between wells has been obtained, and the project has proved extremely valuable to some operators. (See Table G.)

Table C

GEOLOGICAL SURVEYS

Title	Operator	Party Months	Type of Survey
54P ..	Phillips Petroleum Company	½	Field check photogeological mapping
57P ..	Union Oil Development Corporation ..	7	Mapping Surat–Bowen Basins
		2	Subsurface studies Surat Basin
		12	Well sitting
		12	Geology connected with seismic surveys
61P ..	Plymouth Oil Company	⅓	Reconnaissance survey
67P ..	Delhi Australian Petroleum Ltd. ..	8	Chiefly reconnaissance of pre-Mesozoic outcrops in Central Queensland and New South Wales
76P ..	Artesian Basin Oil Company Pty. Ltd.	8	Geological mapping
77P ..	Reef Oil Company Pty. Ltd.	6	Geological mapping
82P ..	Triton of Australia Ltd.	1	Reconnaissance for photogeology
83P ..	Conorada Petroleum Corporation ..	2	Study of Upper Palaeozoic outcrops Drummond Basin
84P ..	Phillips Petroleum Company	1	Stratigraphical reconnaissance
88P ..	Gulf Interstate Overseas	..	General reconnaissance aerial and ground

Table C—continued

BY GOVERNMENT AGENCIES

Surveys Conducted by the Bureau of Mineral Resources–Geological Survey, Queensland

Area	Party Months	Type of Survey
Bowen Basin–Emerald Sheet	3	Reconnaissance
Bowen Basin–Bowen and Mackay Sheets ..	4	Reconnaissance
*Artesian Basin–Brighton Downs, Mackunda, Mackinlay and Julia Creek 4m. sheet areas ..	4	Reconnaissance
Total	71	

*B.M.R. party only.

GEOPHYSICAL SURVEYS

Table D

GRAVITY SURVEYS

Title	Operator	Contractor	Party Months	Area Covered	Traverse Miles	Number of Stations
				Sq. Miles		
54P ..	Phillips Petroleum Company ..	Century Geophysical Corporation	¼	132	..	110
85P ..	Smart Oil Exploration Co. Limited	Geo-surveys of Australia Ltd. ..	5½	3,000	1,000	998

BY GOVERNMENT AGENCIES

Surveys Conducted by the Bureau of Mineral Resources, Geology and Geophysics

Area of Operations	Type of Survey	Party Months	Area Covered	Traverse Miles	Number of Stations
			Sq. Miles		
Birdsville–Mount Whelan–Winton–Windorah	Helicopter Reconnaissance	1¾	50,000	7,000	974
Blackall–Quilpie; St. George–Goondiwindi	Semi-detailed	2	..	320	1,159

Table E

MAGNETOMETRIC SURVEYS (AERIAL)

Title	Operator	Contractor	Party Months	Area Covered	Line Miles Flown
				Sq. Miles	
57P ..	Union Oil Development Corporation ..	Adastra Airways	8	25,450	31,070
66P–67P	Delhi Australian Petroleum Ltd. ...	Aero Service Corporation	1½	21,500	5,777

BY GOVERNMENT AGENCIES

Surveys Conducted by the Bureau of Mineral Resources, Geology and Geophysics

Area of Operations	Type of Survey	Party Months	Line Miles Flown
Clermont–Emerald–Duaringa	Combined Airborne Magnetometer and Scintillograph	2	11,300
Melbourne–Rockhampton (via Bourke)	Aeromagnetic Route Traverse		450 (In Queensland)
Emerald–Roma–Surat–Brisbane	Aeromagnetic Route Traverse		500

Table F

SEISMIC SURVEYS

Title	Operator	Contractor	Party Months	Type of Survey	Method of Survey	Area Surveyed	Length of Subsurface Section	Number of Shot Points	Number of Holes Drilled	Total Footage Drilled	Explosives Used	Detonators Used
						Sq. Miles	Miles				Lbs.	
54P ..	Phillips Petroleum Company	Austral Geo-Prospectors Pty. Ltd.	1·4	Reconnaissance and Detail (reflection)	Continuous correlation ¼-mile shot points	196	59	236	516	49,602	8,500	760
55 and 56P	Mines Administration Pty. Limited	Austral Geo-Prospectors Pty. Ltd.	12·0	Reconnaissance (reflection)	One mile spot correlation points ¾-mile continuous correlation	2,310	608	2,433	2,474	288,594	59,810	5,043
55 and 56P	Mines Administration Pty. Limited	Geophysical Services International S.A.	9·0	Reconnaissance (reflection)	One mile jump correlation continuous	1,700	470	1,878	1,951	200,156	59,715	2,634
57P ..	Union Oil Development Corporation	United Geophysical Inc. ..	17·0	Reconnaissance and Detail (reflection)	Continuous profiling	6,000	930	3,614	3,696	540,501	146,400	5,414
66P and 67P	Delhi Australian Petroleum Ltd.	Namco International Inc. ..	4·7	Reconnaissance (reflection)	Continuous reflection and jump correlation	1,880	192	577	577	89,435	42,992	3,090
70P ..	Pacific American Oil Company	Austral Geo-Prospectors Pty. Ltd.	1·5	Reconnaissance (reflection)	Continuous profiling	43	48·5	194	..	12,009	11,000	242
71P ..	Phillips Petroleum Company	Geoseismic (Aust.) Ltd. ..	2·8	Reconnaissance (reflection)	Continuous profiling	310	90	359	370	48,790	16,630	723
71P ..	Phillips Petroleum Company	Austral Geo-Prospectors Pty. Ltd.	1·6	Detailing (reflection) ..	Continuous profiling	310	39	156	488	83,950	15,746	866
72P ..	Phillips Petroleum Company	Austral Geo-Prospectors Pty. Ltd.	3·4	Reconnaissance (reflection)	Continuous profiling	3,200	164	492	1,258	152,820	32,815	2,059
72P ..	Phillips Petroleum Company	Petty Geophysical Engineering Company	2·1	Reconnaissance (reflection)	Continuous profiling	1,800	108	325	630	78,952	11,490	1,019
75P ..	Conorada Petroleum Corporation	Austral Geo-Prospectors Pty. Ltd.	3·75	Reconnaissance (reflection)	Continuous profiling	725	133	583	653	118,555	24,565	1,475
75P ..	Conorada Petroleum Corporation	Austral Geo-Prospectors Pty. Ltd.	1·0	Reconnaissance (refraction)	Reversed refraction profiles	..	..	60	60	8,420	9,090	208
81P ..	Oil Development N.L. ..	Geoseismic (Aust.) Ltd. ..	2·5	Reconnaissance (reflection)	Continuous profiling	200	108	434	370	31,326	4,925	502
83P ..	Conorada Petroleum Corporation	Austral Geo-Prospectors Pty. Ltd.	1·5	Reconnaissance (reflection)	Continuous profiling	..	68	234	241	32,260	9,255	470
84P ..	Phillips Petroleum Company	Petty Geophysical Engineering Company	22·0	Reconnaissance and Detail (reflection)	Profiling and continuous profiling ..	8,800	1,082	3,258	8,528	912,672	167,031	13,105
84P ..	Phillips Petroleum Company	Austral Geo-Prospectors Pty. Ltd.	5·6	Reconnaissance and Detail (reflection)	Continuous profiling	2,200	308	923	1,799	216,485	45,040	2,480
86P ..	Mines Administration Pty. Limited	Geophysical Services International S.A.	3·0	Reconnaissance and Detail (reflection)	¾-mile correlation and continuous detailing	300	129	515	616	55,136	20,000	863
87P ..	Longreach Oil Limited ..	Geoseismic (Aust.) Ltd. ..	1·0	Reconnaissance and Detail (reflection)	Correlation ¾-mile shot points; Detail ¼-mile shot points	80	58	195	196	19,040	2,695	236
		Totals	95·85			30,054	4,594·5					
				BY GOVERNMENT AGENCIES								
Surveys carried out by the Bureau of Mineral Resources, Geology and Geophysics—												
Goondiwindi–St. George Area, Surat Basin			6·0	(*a*) Regional reflection ..	Continuous reflection profiling at selected intervals	..	99	350	580	60,700	23,000	..
				(*b*) Regional refraction ..	Reverse line refraction profiles (6) ..	..	..	17				
40 miles east of Camooweal, Undilla Basin			1·5	(*a*) Regional reflection ..	Selected traverses on both east and west margins of the basin, and in the expected deepest part of the basin	..	6	26	175	3,830	6,800	..
				(*b*) Regional refraction (4 profiles)	..	..	..	12				
Tambo Area, Eromanga Basin			0·5	(*a*) Regional reflection ..	Continuous profile reflection shooting with one refraction shot in one direction	..	9·75	39	40	3,340	2,400	..
				(*b*) Regional refraction ..	..	..	..	1				
Totals			8·0				114·75					
Grand Totals			103·85			30,054	4,709·25					

Table G

WATER BORE LOGGING

Locality: A.A.O. Combarngo No. 1 Well, 30 miles S.E. of Roma. Birdsville—Boulia area. Longreach—Blackall area.

Arranged by: Qupex, Associated Australian Oilfields, Department of Development and Mines, Irrigation and Water Supply Commission, and Bureau of Mineral Resources, Geology and Geophysics.

Operator: B.M.R. Geophysical (logging) Party.

Crew Months: Four—1 Technical Officer, 1 Field Assistant, 2 Irrigation and Water Supply Commission Officers.

Gamma Ray: Twenty-eight bores logged. Sixty thousand feet of logging.

Temperature: Two bores logged, 6,000 ft. of logging.

PART 4—EXPLORATION DRILLING

Drilling operations have been carried out during the year on two Prospecting Petroleum Permits (P.P.P.'s 704 and 708) and on five Authorities to Prospect (Nos. 55P, 57P, 58P, 84P and 85P). The number of wells drilled and/or completed during the year, totalled twelve as compared with nine for 1960. Four wells were drilling at the end of the year as compared with two at the end of 1960. The total footage drilled during the year was 74,935 ft., a 50 per cent. increase over the figure for 1960.

Figure 2 shows sites and locations of wells drilled during 1961. Table H lists wells drilled during the year, in chronological order. The table is set out under two headings, Rotary Drilling and Percussion Drilling, and it will be noted that the drilling rig used at C.O.L. Speculation No. 1 has been converted from percussion to rotary. No wells classified as Scout Bores have been drilled this year. Depths given are measured from rotary table, kelly bushing, or in the case of percussion drilling, from casing head or drilling floor.

Specific details of the various wells drilled during the year appear in a separate section on drilling in this Supplement.

FIGURE 2

QUEENSLAND

SHOWING

SITES OF OIL WELLS DRILLED IN 1961

SCALE OF MILES

100 0 100 200 300

WEIPA
CAIRNS
TOWNSVILLE
CHARTERS TOWERS
MACKAY
ROCKHAMPTON
BUNDABERG
MARYBOROUGH
HUGHENDEN
CLONCURRY
MT. ISA
WINTON
LONGREACH
EMERALD
SPRINGSURE
ROLLESTON
CHARLEVILLE
ROMA
MILES
CHINCHILLA
TOOWOOMBA
BRISBANE
WARWICK
CUNNAMULLA
NORTHERN TERRITORY
SOUTH AUSTRALIA
NEW SOUTH WALES

INDEX

	No.	Well	Latitude S	Longitude E	Ground Elevation	Height of Rotary Table or Kelly Bushing	Depth at 31–12–61
							Ft.
Rotary Drilling	1	Union-Kern-A.O.G. Cabawin No. 1	27°28′16″	150°11′19″	951′	17′ K.B.	12,035
	2	A.A.O. Pickanjinnie No. 2	26°37′00″	149°08′00″	1042′	10′	5,591
	3	Phillips–Sunray Buckabie No. 1	26°11′40″	144°16′05″	724′	14′	9,070
	4	A.A.O. Combarngo No. 1	26°51′00″	149°09′00″	918′	10′	5,985
	5	Delhi-Santos Mornington Island No. 1 ..	16°32′44″	139°15′27″	47′	10′	2,764
	6	Delhi-Santos Mornington Island No. 2 ..	16°29′13″	139°31′11″	24′	10′	3,000
	7	Union-Kern-A.O.G. Cabawin East No. 1 ..	27°29′10″	150°15′15″	993′	17′ K.B.	12,091
	8	Phillips-Sunray Cothalow No. 1	25°43′47″	144°23′41″	791′	14′	6,025
	9	A.A.O. Winnathoola No. 1	26°45′20″	149°05′26″	1010′	10′	5,342
	10	Phillips-Sunray Etonvale No. 1	25°09′40″	144°59′40″	1083·5′	14′	8,542
	11	Union-Kern-A.O.G. Moonie No. 1	27°44′30″	150°15′25″	870′	17′ K.B.	6,106
	12	A.A.O. Glentulloch No. 1	25°47′17″	148°22′47″	1507′	10′	4,083
Percussion Drilling	13	Standard Gas Cribb Island No. 1	27°22′25″	153°07′05″	6′	1′ height of collar	2,001
	14	Smart Orient No. 1	27°40′15″	143°09′00″	446′	4′-floor	3,200
	15	Smart Orient No. 2	27°40′10″	143°11′25″	426′	4′-floor	2,130

Table H

FOOTAGES OF WELLS DRILLED IN 1961—(in chronological order)

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remarks as at End of Year
		ROTARY DRILLING			
C.O.L. No. 1 (Speculation)	Chinchilla (P.P.P. 708)	Condamine Oil Ltd.	..	..	Fishing until September, 1961, when lost tools recovered. Now awaiting well head equipment. Current depth 2321 feet (previously reported as 2333 feet)
Union–Kern–A.O.G. Cabawin No. 1	26 miles south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation. (Oil Drilling and Exploration Ltd.)	2,083	12,035	Non-commercial production of oil and gas on test. Completed, shut in, suspended
A.A.O. Pickanjinnie No. 2	Pickanjinnie 20 miles east of Roma (55P)	Associated Australian Oilfields N.L., with whom are associated Associated Freney Oilfields N.L. and the Papuan Apinaipi Petroleum Co. Ltd. (Mines Administration Pty. Ltd.)	5,591	5,591	Minor gas and oil shows. Well plugged
Phillips–Sunray Buckabie No. 1	29 miles north of Quilpie (84P)	Phillips Petroleum Co. and Sunray Mid-Continent Oil Co. (Delta Drilling Co.)	9,070	9,070	Plugged as dry well
A.A.O. Combarngo No. 1	30 miles south-east of Roma (55P)	Associated Australian Oilfields N.L., with whom are associated Associated Freney Oilfields N.L. and the Papuan Apinaipi Petroleum Co. Ltd. (Mines Administration Pty. Ltd.)	5,985	5,985	Some oil indications. Completed as a water well
Delhi–Santos Mornington Island No. 1	Mornington Island, Wellesley Group, Gulf of Carpentaria (58P)	Santos Limited and Delhi Australian Petroleum Ltd. (Mines Administration Pty. Ltd.)	2,764	2,764	Plugged as a dry well
Delhi–Santos Mornington Island No. 2	Mornington Island, Wellesley Group, Gulf of Carpentaria (58P)	Santos Limited and Delhi Australian Petroleum Ltd. (Mines Administration Pty. Ltd.)	3,000	3,000	Plugged as a dry well
Union–Kern–A.O.G. Cabawin East No. 1	22 miles south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation (Oil Drilling Exploration Ltd.)	12,091	12,091	No significant oil or gas shows. Completed as a water well
Phillips–Sunray Cothalow No. 1	18 miles north-west of Adavale (84P)	Phillips Petroleum Co. and Sunray Mid-Continent Oil Co. (Delta Drilling Co.)	6,025	6,025	Plugged as a dry well

Table H—*continued*

FOOTAGES OF WELLS DRILLED IN 1961—(in chronological order)—*continued*

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remarks as at End of Year
		ROTARY DRILLING—*continued*			
A.A.O. Winnathoola No. 1	20 miles south-east of Roma (55P)	Associated Australian Oilfields N.L., with whom are associated Associated Freney Oilfields N.L., Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., Sleigh Exploration N.L. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	5,342	5,342	Gas encountered. Well plugged and completed as a water well
Phillips–Sunray Etonvale No. 1	60 miles south-west of Blackall (84P)	Phillips Petroleum Co. and Sunray Mid-Continent Oil Co. (Delta Drilling Co.)	8,542	..	Drilling
Union–Kern–A.O.G. Moonie No. 1	34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation (Oil Drilling and Exploration Ltd.)	6,106	6,106	Initial tests indicate possible production in order of ±2000bbl/day. Well now on final production test
A.A.O. Glentulloch No. 1	12 miles west of Injune (55P)	Associated Australian Oilfields N.L., with whom are associated Associated Freney Oilfields N.L., Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., Sleigh Exploration N.L. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	4,083	4,083	Potential gas producer. Well being cased in preparation for testing
		PERCUSSION DRILLING			
Standard Gas Cribb Island No. 1	Cribb Island, Brisbane P.P.P.704	Standard Gas Pty. Ltd. (Godfrey Bros. Pty. Ltd.)	581	..	Total depth now 2001 ft. Preparations in hand to deepen to 3000 ft.
*Smart Orient No. 1 ..	Orient, via Thargomindah, south-west Queensland (85P)	L. H. Smart Oil Exploration Ltd. (J. R. Robinson)	1,542	3,200	Dry hole. Completed as a water well
Smart Orient No. 2 ..	Orient, via Thargomindah, south-west Queensland (85P)	L. H. Smart Oil Exploration Ltd. (J. R. Robinson)	2,130	..	Drilling

* Previously classified as a Scout Bore; deepened to 3,200 ft. in 1961.

Summarised the above details are shown in the following table:—

Table I—WILDCAT DRILLING

Footage drilled during the year	74,935 ft. (4,253 ft. percussion; balance rotary)
Number of wells drilling at 31st December, 1961	4
Number of wells drilled and/or completed during the year and results :—	
(*a*) dry hole—plugged	5
(*b*) oil/gas shows—plugged	4
(*c*) oil/gas shows—completed closed in, suspended ..	1
(*d*) oil/gas shows—testing	2
Total	12

SCOUT DRILLING—No scout bores drilled during the year.

PART 5—EMPLOYMENT AND ACCIDENTS

Employment in the industry in 1961 has shown a marked increase over 1960, more than twice the number of personnel being engaged. The most notable increase has been in staff employed on Exploration Drilling, the 1961 figure showing a 250 per cent. increase over 1960.

The statistics are given in slightly different form this year, and now show field workers in different categories, as distinct from administrative and office workers. The employment figures for Government agencies include both geologists and geophysicists employed by the Bureau of Mineral Resources and geologists of the Geological Survey of Queensland.

The number of personnel employed has been averaged out to represent total employment in the State for the year, which amounts to 593 employees as shown in Table J.

Accident statistics have been compiled only in respect of drilling operations, and show a 200 per cent. increase on 1960 figures. One third of the accidents were caused by crushing and fracturing of fingers and hands, chiefly in the use of tongs in making up drill pipe and latching drill pipe to elevators. The attention of operators is drawn to this frequent cause of injury and lost time.

Table J

EMPLOYMENT

Field									Office and Administration			Total
Geological and Geophysical Surveys				Exploration Drilling								
Geologists and Geophysicists		Technicians and Helpers		Supervisors, Petroleum Engineers, Geologists, Toolpushers and Drillers		Drilling Crews		Others	Operator's Employees			
Employed by		Employed by		Employed by		Employed by						
Operator	Contractor	Operator	Contractor	Operator	Contractor	Operator	Contractor		Geologists and Geophysicists	Drilling	Clerical and Administrative	
10	32	1	312	9	18	4	71	37	21	5	56	576
Employed by Government Agencies												
6	..	11	..	..	..	..	..	..	..	..	..	17
Totals 16	32	12	312	9	18	4	71	37	21	5	56	593

Table K

DETAILED CLASSIFICATION OF ACCIDENTS
(Lost Time only)

Nature of Injuries	Occupation					Injured Member								Agency of Injury					
	Toolpushers	Drillers	Drilling Crew	Others	Total	Fingers	Hands	Arms	Toes	Feet	Legs	Head	Body	Total	Moving Machinery	Using Tools	Handling Tubulars	Falling Objects	Other Causes	Total
Sprains, Contusions and Abrasions	..	..	17	4	21	4	3	2	1	2	..	1	8	21	..	6	5	..	10	21
Cuts and Lacerations	..	..	1	1	2	2	..	..	..	..	..	..	..	2	..	..	..	..	2	2
Fractures	..	..	8	..	8	4	..	..	1	2	..	..	1	8	..	5	..	1	2	8
Burns	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Other Injuries	..	..	1	1	2	..	..	..	..	..	..	2	..	2	..	..	..	..	2	2
Totals	..	..	27	6	33	10	3	2	2	4	..	3	9	33	..	11	5	1	16	33

PART 6—LEGISLATION AND INSTRUCTIONS TO OPERATORS

There were no changes in the legislation governing the industry—"*The Petroleum Acts,* 1923 *to* 1958," during the year. Various changes are contemplated and it is hoped that new legislation to bring these into effect will be enacted in the next session of Parliament. The instructions issued to operators have been revised and were re-issued in December 1961 to all operators.

PART 7—GENERAL SURVEY OF THE INDUSTRY

The most important event during the year was undoubtedly the discovery in December of oil less than 6,000 ft. deep in the well Union-Kern-Australian Oil and Gas Moonie No. 1 on Authority to Prospect 57P. On drill-stem tests, the well flowed at rates of production up to 2,196 barrels per day. Following on the discovery earlier in the year of non-commercial petroleum in the well U.K.-A.O.G. Cabawin No. 1, the Moonie discovery has given rise to the hope that proof of the existence of oil in commercial quantities in Queensland is at hand. Another highlight was the further discovery of gas in Associated Australian Oilfields Glentulloch No. 1 well 12 miles west of Injune. On drill-stem tests at various horizons above 2,750 ft. this well produced dry gas at a total rate of some 7 m.m.c.f. per day.

An important occasion took place on 19th April, when the Governor of Queensland turned on the initial supply of natural gas from the wells A.A.O. No. 4 Hospital Hill, and A.A.O. Timbury Hills No. 2, to the Roma Town Power Station. This event is one of major significance and may well mark the beginning of the first successful development of the natural gas resources of the region. A steady and regular supply of this fuel to Roma town was well established by the end of 1961, and showed every promise of continuation.

A marked increase in exploration activity over 1960 is apparent, particularly in the field of seismic surveys. Work of this description carried out by the operators was more than double, at 95.8 party months, that of 1960. In all over 103 party months' seismic work was performed resulting in more than 30,000 square miles of subsurface contouring. Aerial magnetometrics showed a similar 100 per cent. increase with almost 12 party months' work in 1961 against 6 for 1960.

A reduction in the use of the quick geophysical reconnaissance tool, namely gravity surveys, is to be noted. This is a normal trend when these surveys are superseded by seismic work, but large areas still remain where this tool could be used to advantage to assist in defining areas of structural significance.

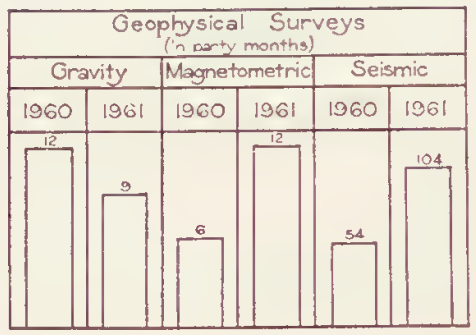
Estimated expenditure for the coming year at £7,370,000, is approximately 75 per cent. greater than the actual expenditure in 1961 (4.2 million) and it is significant that about two-thirds of the expenditure proposed for 1962 will be on exploration drilling. Of great significance also, is the fact that of the twelve wells drilled in the State in 1961, no fewer than seven contained oil and/or gas shows, and two of them (Glentulloch No. 1 and Moonie No. 1) gave promise of possible commercial production of gas and oil respectively.

Indications are that 1962 will prove to be an important year in the history of oil exploration in Australia. Indeed it could well be that this year will see established the promise of commercial production of oil in Queensland.

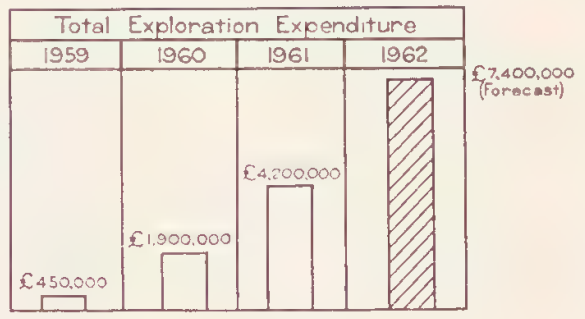
APPENDIX

Graphs illustrating recent progress in Oil Exploration in Queensland

Graph (a)



Graph (b)



Graph (a) Indicates activity in geophysical surveys for the past two years. Statistics for previous years are not available.

Graph (b) Illustrates the increase in total expenditure on all types of exploration since 1959.

Graph (c) Shows the rapid increase in employment in the industry over the past 2 years.

Graph (d) The marked increase in exploration drilling since 1959 is shown. Also to be expected is trebled activity in 1962 over 1961.

Graph (c)

Graph (d)

DRILLING RESULTS

By I. G. SANKER, Geologist

This section presents a short history of each of the wells drilled in Queensland for petroleum during 1961. The details of each well were summarised from progress reports and well completion reports submitted to the Department of Mines by the companies concerned. The stratigraphic names are those used by the companies, and are not necessarily in accordance with the Australian Code of Stratigraphic Nomenclature.

The correlation of the Mesozoic strata of the Surat Basin is reviewed by Mr. R. J. Allen, Geologist, in a note appended to this section.

A.A.O. Pickanjinnie No. 2

This well was located at lat. 26°37′S., long. 149°08′E., about 20 miles east from Roma. It was located on an anticlinal structure (the Pickanjinnie Structure) which had been defined by seismic methods. Pickanjinnie No. 2 was about 1 mile 6 chains south-south-east of A.A.O. Pickanjinnie No. 1, and was sited down structure in an attempt to establish the water levels in the gas sands in the anticline. The drilling contractor was Mines Administration Pty. Ltd., using a National T-32 drilling rig. Rotary table elevation was 1,052 ft., 10 ft. above surface elevation. The well was spudded on 9th January, 1961, and reached total depth of 5,591 ft. on 13th February, 1961.

Twelve and one-quarter-inch hole was drilled from surface to 248 ft., 241 ft. of 9⅝ in. 40-lb. casing then being run and cemented to surface. Eight and one-half-inch hole was drilled from 248 ft. to total depth.

Five conventional cores were taken, from 5,080-5,093 ft., 5,303–5,307 ft., 5,473–5,484 ft., 5,555–5,559 ft., and 5,586–5,591 ft., coring 37 ft. with 93½ per cent. recovery. Twenty-one sidewall cores were taken between 3,750 ft. and 5,235 ft. Schlumberger ran electric logs (in 5 runs) between 242 ft. and 5,480 ft., micrologs between 4,000–4,200 ft. and 5,050–5,200 ft., and a laterolog from 4,000 ft. to 4,300 ft. Section gauges and deviation surveys were also run. A Rotary gas log was run between 4,070–5,588 ft.

The stratigraphic succession was reported as—

0– 350 ft.	Roma Formation	
350– 518 ft.	Transition Member	Blythesdale Formation
518– 810 ft.	Mooga Member	
810– 952 ft.	Fossilwood Member	
952–1,470 ft.	Gubberamunda Member	
1,470–2,993 ft.	Walloon Coal Measures	
2,993–3,577 ft.	Bundamba Sandstone	
3,577–4,266 ft.	Moolayember Formation	
4,266–4,646 ft.	Pickanjinnie Formation	
4,646–5,250 ft.	Latemore Formation	
5,250–5,591 ft.	Timbury Hills Formation	

The target horizons were encountered at—

4,132–4,172 ft.	Hospital Hill/Links Sandstone
4,258–4,266 ft.	Showground Sandstone

A trace of oil bleeding was noted in the Latemore Formation (core 1), and fluorescence and oil bleeding was recorded in the Timbury Hills Formation (cores 2 and 3). These petroleum indications in the Timbury Hills Formation were noted on fracture surfaces.

Five drill stem tests were conducted, the results of which are summarized below—

4,110–4,200 ft.	Nil (packer failed to seat)
4,006–4,200 ft.	Gas (75 mcf.), water
5,020–5,233 ft.	Minor gas; gas cut mud
5,261–5,484 ft.	Nil (packer failed to seat)
5,270–5,484 ft.	Gas (75 mcf.); gas cut mud

The well was plugged between 5,250–5,350 ft., 5,080–5,180 ft., 4,100–4,200 ft., 3,600–3,700 ft., 1,500–1,600 ft. and 0–50 ft., and abandoned as a dry hole on 14th February, 1961.

A.A.O. Combarngo No. 1

This well was located at lat. 26°51′S., long. 149°09′E., about 30 miles south-east from Roma, on the crest of a seismic high. The drilling contractor was Mines Administration Pty. Ltd., using a National "Ideal" 55 rig. Ground elevation was 918 ft., and rotary table elevation 928 ft. The well was spudded on 5th May, 1961, and reached total depth of 5,985 ft. on 10th June. The work was subsidised by the Commonwealth Government.

Seventeen and one-half-inch hole was drilled from surface to 312 ft.; 13⅜ inch 48-lb. casing was run to setting depth 306 ft. and cemented to surface. Eight and one-half-inch hole was drilled from 312 ft. to total depth; 6⅝ inch 20-lb. casing was set to 5,125 ft. and cemented to 4,400 ft.

Ten conventional cores were taken, coring 93½ ft., with 74 per cent. recovery. Fifty-three sidewall cores were taken between 693 ft. and 5,082 ft. Schlumberger ran electric logs between 306 ft. and 5,986 ft., a laterolog from 4,650 ft. to 5,093 ft., and micrologs between 4,150 ft. and 5,630 ft. The Bureau of Mineral Resources ran a gamma log from 30 ft. to 4,800 ft., and Schlumberger ran one from 4,800 ft. to 5,119 ft. A continuous gas log, using a Rotary detector, was kept between 306 ft. and 5,985 ft. A section gauge, temperature survey, deviation surveys and velocity survey were also run.

The stratigraphic units encountered in the well were reported to be:—

0– 965 ft.	Roma Formation	
965–1,283 ft.	Transition Member	Blythesdale Formation
1,283–1,425 ft.	Mooga Member	
1,425–1,891 ft.	Fossilwood Member	
1,891–2,216 ft.	Gubberamunda Member	
2,216–3,710 ft.	Walloon Coal Measures	
3,710–4,350 ft.	Bundamba Sandstone	
4,350–5,086 ft.	Moolayember Formation	
5,086–5,315 ft.	Pickanjinnie Formation	
5,315–5,628 ft.	Latemore Formation	
5,628–5,985 ft.	Volcanics (andesite and andesitic tuff)	

The target horizons were basal members of the Moolayember Formation—

4,714–4,731 ft.	Hospital Hill/Links Sandstone
5,078–5,086 ft.	Showgrounds Sandstone

These sandstones were found to be water-filled, although 4 barrels of 52° API gravity oil were recovered from the Showgrounds Sandstone in a drill-stem test. Fluorescence was noted in the Pickanjinnie Formation, and patchy oil staining and fluorescence in the Latemore Formation and in the volcanics.

Five formation tests were conducted, with the following results:—

5,074–5,109 ft.	(open hole)	Gas (75 mcf), oil (4 bbl.), water.
5,489–5,644 ft.	(open hole)	Gas (10 mcf), mud.
5,076–5,077½ ft.	(perf.)	Water, trace of oil.
5,082–5,083½ ft.	(perf.)	Nil (test abortive).
5,076–5,077½ ft.	(perf.)	Water.

The hole was plugged between 5,150–5,300 ft., 5,082–5,083½ ft. (squeezed through perforations), 5,076–5,077½ ft. (squeezed through perforations), 4,987–5,087 ft., 4,290–4,310 ft., 3,990–4,010 ft., 3,490–3,510 ft., 1,990–2,010 ft. and 1,842–1,882 ft. and abandoned as a dry hole on 9th July, 1961. It was later completed as a water well, producing from the Blythesdale Formation.

A.A.O. Winnathoola No. 1

This well was located at lat. 26°45′20″ S., long. 149°05′26″ E., 22 miles south-east from Roma. The drilling was designed to test an anticlinal structure (the Winnathoola Structure), determined by seismic methods. The drilling contractor was Mines Administration Pty. Ltd., using a National 55 drilling rig. Ground elevation was 1,010 ft., and rotary table elevation 1,020 ft. Drilling began on 1st September, 1961, and reached total depth of 5,342 ft. on 22nd September, 1961. The Commonwealth Government subsidised the work in the lower section of the well, below the predicted top of the Bundamba Formation at 3,350 ft.

Twelve and one-quarter-inch hole was drilled from surface to 320 ft. The hole was reamed to 17½ in., and 310 ft. of 13⅜ in. 48-lb. casing was run and cemented to surface. Eight and one-half-inch hole was then drilled to total depth.

Four conventional cores were taken, from 4,345–4,353 ft., 4,818–4,828 ft., 4,938–4,948 ft. and 5,293–5,300 ft. coring 35 ft. with 86 per cent. recovery. Nineteen sidewall cores were taken between 4,230–5,120 ft., Schlumberger ran electric logs (in 4 runs) between 311 ft. and 5,341 ft., and a microlog between 4,350 ft. and 4,518 ft. Deviation surveys and a section gauge were also run. A continuous gas-detection unit was maintained.

The stratigraphic succession encountered in the hole was reported to be—

0– 640 ft.	Roma Formation	
640– 908 ft.	Transition Member	Blythesdale Formation
908–1,290 ft.	Mooga Member	Blythesdale Formation
1,290–1,732 ft.	Fossilwood Member	Blythesdale Formation
1,732–2,003 ft.	Gubberamunda Member	Blythesdale Formation
2,003–3,469 ft.	Walloon Coal Measures	
3,469–4,103 ft.	Bundamba Sandstone	
4,103–4,744 ft.	Moolayember Formation	
4,744–4,919 ft.	Pickanjinnie Formation	
4,919–5,126 ft.	Latemore Formation	
5,126–5,342 ft.	Timbury Hills Formation	

The Hospital Hill Sandstone was encountered at 4,483–4,489 ft.

Indications of petroleum were encountered in the lower section of the hole. Fluorescence and cut were noted in the Moolayember, Pickanjinnie, Latemore and Timbury Hills Formations. A flow of fairly dry gas was met in the Hospital Hill Sandstone. Two drill-stem tests were conducted, the results of which are summarized as—

4,465–4,521 ft. (Hospital Hill Sandstone). Gas (616 mcf.)
5,035–5,342 ft. Gas (flow too small to measure).

The well was plugged with cement plugs set at 4,400–4,550 ft., 4,050–4,150 ft., 3,400–3,500 ft., and 2,050–2,150 ft. on 23rd September, 1961. It was subsequently completed as a water well, producing from the Blythesdale Formation.

A.A.O. Glentulloch No. 1

This well was located at lat. 25° 47′ 17″ S., long. 148° 22′ 47″ E., about 12 miles west-north-west of Injune. It was drilled to test the seismically-determined Glentulloch Structure for possible hydrocarbon accumulation, and to assist in the interpretation of seismic work carried out in the area. The drilling contractor was Mines Administration Pty. Ltd., using a National T-32 drilling rig. The well was spudded on 20th November, 1961, and reached total depth of 4,083 ft. on 24th December, 1961. Ground elevation was 1,507 ft., and rotary table elevation 1,517 ft. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 270 ft., and 9⅝ in. 40-lb. casing was set to 263 ft. and cemented to surface. Eight and one-half-inch hole was drilled from 270 ft. to total depth.

Twenty-two conventional cores were cut, covering, at regular intervals, the hole between 501 ft. and 4,051 ft. Cores 11 to 15 cover a continuous section from 2,510–2,600 ft. Average recovery was 76 per cent. Schlumberger ran an electric log from 264–4,082 ft., microlog from 2,440–2,871 ft., laterolog from 2,300–3,000 ft., gamma ray log from 0–3,002 ft., temperature log from 290–1,980 ft., and a section gauge from 263–3,229 ft. A velocity survey was run and an automatic gas-detection unit was maintained.

The company reported the stratigraphic section to be—

0– 40 ft.	Injune Creek Beds	
40– 973 ft.	Hutton Sandstone	
973–1,139 ft.	Boxvale Sandstone	Bundamba Group
1,139–1,348 ft.	Evergreen Shale	Bundamba Group
1,348–1,572 ft.	Precipice Sandstone	Bundamba Group
1,572–1,683 ft.	Moolayember Formation?	
1,683–2,092 ft.	Bandanna Formation	
2,092–2,220 ft.	Mantuan Productus Bed	
2,220–2,496 ft.	Dry Creek Shale	
2,496–2,658 ft.	Early Storms Sandstone	
2,658–2,914 ft.	Staircase Sandstone	
2,914–3,505 ft.	Conglomerate A	
3,505–4,007 ft.	Conglomerate B	
4,007–4,083 ft.	Timbury Hills Formation	

Gas bleeding was noted in core 15 (conglomeratic sandstone) at 2,585–2,600 ft., and in core 16 (siltstone and sandstone) at 2,700–2,720 ft. Six drill-stem tests were conducted. The results are summarized below—

D.S.T.1 (2,470–2,530 ft.).	The sand at 2,494–2,530 ft. produced 1,750 mcf/d. of dry gas.
D.S.T.2 (2,535–2,550 ft.).	Dry sand.
D.S.T.3 (2,535–2,585 ft.).	Minor quantity of gas.
D.S.T.4 (2,579–2,720 ft.).	2,468 mcf/d. gas.
D.S.T.5 (2,727–2,809 ft.).	2,924 mcf/d. gas.
D.S.T.6 (2,804–2,875 ft.).	Estimated 6 mcf/d. gas and 840 bbls/d. saline water.

The hole was plugged back from total depth to 3,016 ft., and 6⅝ in. 20-lb. production casing was set to 3,006 ft., and cemented to 1,005 ft. Testing of the well through perforated casing will continue.

Condamine Oil Ltd. No. 1 (Speculation)

Fishing and milling operations to recover the stuck percussion tool continued, and the hole was finally cleared on 6th September, 1961, after which it was cleaned and conditioned. Remeasurement indicated total depth to be 2,320 ft. (not 2,332 ft. as previously stated), and this was deepened to 2,321 ft. in conglomerate. Drilling is suspended, while equipment is being overhauled.

Delhi-Santos Mornington Island No. 1

This well was situated on Mornington Island in the Gulf of Carpentaria, and was located at lat. 16° 32′ 44″ S., long. 139° 15′ 27″ E. The well was drilled on the west flank of an anticlinal structure which had been mapped by shallow structure drilling. The well was designed to test the petroleum possibilities of the Mesozoic strata and to investigate the possibility that Lower Palaeozoic rocks known to outcrop to the south could extend into the area. The drilling contractor was Mines Administration Pty. Ltd., using a National Ideal T-32 drilling rig. Rotary table elevation was 57 ft., 10 ft. above ground elevation. The well was spudded on 22nd May, 1961, and reached total depth of 2,764 ft. on 3rd June, 1961. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 235 ft., after which 9⅝ in. 40-lb. casing was set to 234 ft., and cemented to surface. Seven and seven-eighths-inch hole was drilled from 235 ft. to total depth.

Nine conventional cores were cut coring 76 ft. with 67¼ ft. (or 89 per cent.) recovery. Electric logs were run by Oil Drilling and Exploration Ltd. using a Failing Logmaster unit from 234 ft. to 2,764 ft., and a gamma ray log was run from 50 ft. to 2,764 ft. Deviation surveys were also run and a continuous gas-detection unit was maintained.

The stratigraphic sequence was reported to be—

0– 182 ft.	Recent and Tertiary
182– 827 ft.	Winton Formation
827–1,854 ft.	Tambo Formation
(1,795–1,854 ft.	"Fishscale Zone"—base of Tambo Formation)
1,854–2,524 ft.	Roma Formation
2,524–2,725 ft.	Blythesdale Group
2,725–2,743 ft.	Weathered Zone—Pre-Jurassic
2,743–2,764 ft.	Adamellite (basement)—Pre-Jurassic

No oil or gas indications were observed in the well. Four drill-stem tests were conducted, at 2,529–2,552 ft., 2,634–2,659 ft., 2,641–2,659 ft., and 2,696–2,752 ft., all to test zones in the Blythesdale Formation, but all four were failures due to a faulty testing tool.

The well was plugged from 2,455–2,505 ft. and 205–255 ft. capped and abandoned as a dry hole on 5th June, 1961.

Delhi–Santos Mornington Island No. 2

This well was located at lat. 16° 29′ 13″ S., long. 139° 31′ 11″ E., 18 miles east-north-east of D.S. Mornington Island No. 1. It was situated far down the eastern flank of the anticlinal structure defined by shallow structure drilling. The drilling contractor was Mines Administration Pty. Ltd., using a National Ideal T-32 drilling rig. Rotary table elevation was 34 ft., and ground elevation 24 ft. The well was spudded on 19th June, 1961, and reached total depth of 3,000 ft. on 26th June. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 117 ft., 9⅝ in. 40-lb. casing then being set to 112 ft., and cemented to surface. Seven and seven-eighths-inch hole was drilled from 117 ft. to total depth.

Two conventional cores were cut, both in the lower section of the hole, between 2,813–2,823 ft., and 2,998–3,000 ft. Recovery was 92 per cent. (or 11 ft. of core). Electric logs were run between 112 ft. and 3,000 ft., by Oil Drilling and Exploration Ltd., using a Failing Logmaster unit. A gamma ray log was run from 50–3,000 ft. Deviation and temperature surveys were run, and a continuous gas-detection unit was maintained.

The stratigraphic section penetrated was reported to be—

0– 177 ft.	Recent and Tertiary
177–1,066 ft.	Winton Formation
1,066–2,110 ft.	Tambo Formation
(2,037–2,110 ft.	"Fishscale Zone"—base of Tambo Formation)
2,110–2,785 ft.	Roma Formation
2,785–2,991 ft.	Blythesdale Group
2,991–3,000 ft.	Quartzite (basement)

No gas shows were recorded, and the only indication of petroleum was "dead oil" staining in sandstone between 2,980 ft. and 2,991 ft. Three drill-stem tests were conducted, at 2,067–2,127 ft., 2,787–2,823 ft. and 2,976–2,994 ft. Test 1 recovered drilling mud only, indicating lack of porosity and permeability of the tested zone. Tests 2 and 3 recovered water from artesian-water sands.

The well was plugged from 2,760–2,810 ft., and 100–150 ft., capped, and abandoned as a dry hole on 27th June, 1961.

Phillips–Sunray Buckabie No. 1

This well was located at lat. 26° 11′ 40″ S., long. 144°16′05″E., about 30 miles north from Quilpie. It was drilled on the crest of an anticlinal structure mapped by seismic methods, for the purpose of determining the petroleum prospects in a thick sedimentary section. The drilling contractor was Delta Drilling Company, and the rig a National 130. Rotary table elevation was 737.7 ft., and ground elevation 723.8 ft. The well was spudded on 1st May, 1961, and total depth of 9,070 ft. was reached on 8th July, 1961. The work was subsidised by the Commonwealth Government.

Twenty-six-inch hole was drilled from surface to 49 ft., 20 in. 94-lb. casing then being set to 48 ft. and cemented to surface. Seventeen and one-half-inch hole was drilled from 49 ft. to 802 ft., and 13⅜ in. 48-lb. casing was set to 799 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 802 ft. to 5,725 ft., 9⅝ in. 40-lb. and 36-lb. casing then being set to 5,725 ft., and cemented to 2,006 ft. Eight and five-eighths-inch hole was drilled from 5,725 ft. to total depth.

Twenty-three conventional cores were cut, between 1,123 ft. and 9,070 ft., coring 308 ft. and recovering 203.2 ft. (or 66 per cent.). Eleven sidewall cores were taken between 1,060 ft. and 2,370 ft. Welex ran numerous wireline logs. Induction-Electric and FoRxo logs were run from total depth, 9,070 ft., to 798 ft., and the Guard log from T.D. to 5,725 ft. Acoustic velocity and radioactivity logs were run from surface to T.D. Caliper logs were run from 42 ft. to T.D. and a temperature log from 150 ft. to 3,000 ft. Deviation and velocity surveys were also conducted. A continuous logging service and gas-detection unit was maintained by Core Laboratories Inc.

The stratigraphic units penetrated in the well were reported to be—

Surface–126 ft.	Surface soil, duricrust and laterite	
126–1,126 ft.	Winton Formation	
1,126–2,354 ft.	Tambo Formation	
2,354–3,164 ft.	Roma Formation	
3,164–3,434 ft.	Transition Beds	Blythesdale Group
3,434–3,952 ft.	Mooga Sandstone	
3,952–4,106 ft.	Fossil Wood Beds	
4,106–4,808 ft.	Gubberamunda Sandstone	
4,808–5,216 ft.	Walloon Coal Measures	
5,216–8,810 ft.	"Buckabie Beds"	
8,810–9,070 ft.	Basement	

The term "Buckabie Beds" is used informally for a "red-bed" sandstone-shale-conglomerate sequence occurring below an unconformity at 5,216 ft. The basement rocks consisted of low-grade metamorphics, phyllitic mudstone and quartzitic sandstone, dipping at 75-80°, and strongly slickensided.

The well was reported to be dry, with no significant indications of gas or oil in the gas detectors or oil fluorescence in the cutting samples. Five drill-stem tests were conducted to test for formation fluids in the Pre-Jurassic section. The results are summarised as—

D.S.T.1.	8,398-8,650 ft.	Packers failed to seat.
D.S.T.2.	8,488-8,650 ft.	No formation fluids produced.
D.S.T.3.	7,901-8,091 ft.	No formation fluids produced.
D.S.T.4.	7,888-8,090 ft.	Packers failed to seat.
D.S.T.5.	7,688-7,920 ft.	No formation fluids produced.

Cement plugs were placed at 7,920-8,230 ft., 5,625-5,825 ft. and 145-245 ft., and the well was capped and abandoned on 20th July, 1961.

Phillips-Sunray Cothalow No. 1

This well was located at lat. 25°43′47″S., long. 144°23′41″E., 18 miles north-west from Adavale. It was drilled to test the petroleum prospects of an elongate domal structure (the Cothalow Anticline) located in 1961 during reconnaissance seismic survey by Petty Geophysical Engineering Co. The drilling contractor was Delta Drilling Co., using a National 130 drilling rig. Rotary table elevation was 805 ft., and ground elevation 791 ft. The well was spudded on 5th August, 1961, and total depth of 6,025 ft. was reached on 30th August, 1961. The work was subsidised by the Commonwealth Government.

Seventeen and one-quarter-inch hole was drilled from surface to 605 ft., 20 in. 94-lb. casing was set to 19 ft., and 13⅜ in. 48-lb. casing was set to 603·81 ft., and both strings were cemented to surface. Twelve and one-quarter-inch hole was drilled from 605 ft. to 916 ft., and 8¾-in. hole from 916 ft. to 6,025 ft.

Eight conventional cores were cut, between 1,883 ft. and 6,025 ft., coring, in all, 107 ft. with recovery of 62·3 ft. (or 58·2 per cent.). Twenty-one sidewall cores were taken between 1,195 ft. and 5,065 ft. Welex ran numerous wireline logs. Induction-Electric logs were run from 603 ft. to 6,010 ft., guard logs from 603 ft. to 6,007 ft., FoRxo/caliper logs from 604 ft. to 6,010 ft., radioactivity logs from 50 ft. to 6,011 ft., acoustic velocity logs from 60 ft. to 6,008 ft. and a continuous dipmeter log from 3,550 ft. to 6,011 ft. Deviation surveys were conducted, and maximum temperatures were recorded. Core Laboratories Inc. maintained a continuous logging service and a continuous gas-detection unit.

The stratigraphic succession was reported to be—

Surface–140 ft.	Duricrust and laterite	
140–1,261 ft.	Winton Formation	
1,261–1,871 ft.	Upper Tambo Formation	
1,871–2,524 ft.	Lower Tambo Formation	
2,524–3,351 ft.	Roma Formation	
3,351–3,593 ft.	Transition Beds	Blythesdale Group
3,593–4,096 ft.	Mooga Sandstone	
4,096–4,206 ft.	Fossil Wood Beds	
4,206–4,963 ft.	Gubberamunda Sandstone	
4,963–5,250 ft.	Walloon Coal Measures	
5,250–6,025+ft.	"Buckabie Beds"	

There is an unconformity at 5,250 ft.

No oil or gas was reported. However, poor shows were logged from 4,345–4,350 ft. and 4,996–5,005 ft. Seven drill-stem tests were conducted to evaluate formation fluids. The results are tabulated below—

D.S.T.1.	1,589–1,820 ft.	Recovered fresh water
D.S.T.2.	3,358–3,451 ft.	No fluids produced
D.S.T.3.	3,587–3,653 ft.	Flowed fresh water
D.S.T.4.	3,843–4,144 ft.	Flowed fresh water
D.S.T.5.	4,289–4,343 ft.	Flowed fresh water
D.S.T.6.	4,981–5,034 ft.	Flowed fresh water
D.S.T.7.	5,850–6,010 ft.	Recovered brackish water

The hole was plugged from 5,150–5,300 ft., 3,720–3,870 ft., 3,450–3,600 ft., 550–650 ft. and 20–25 ft., capped, and abandoned on 31st August, 1961.

Phillips-Sunray Etonvale No. 1

This well was located at lat. 25°09′40″S., long. 144°59′40″E., 58 miles south-south-west from Blackall. The well was drilled as a test (on a structure determined by seismic methods) of the Palaeozoic section which unconformably underlies the Mesozoic section of the Great Artesian Basin. The drilling contractor was Delta Drilling Co., and the rig a National 130. Rotary table elevation was 1,097·5 ft., and ground elevation 1,083·5 ft. The well was spudded on 27th September, 1961, and had reached a depth of 8,542 ft. on 31st December. The work was subsidised by the Commonwealth Government.

Seventeen and one-half-inch hole was drilled from surface to 800 ft., and 13⅜ in. 48-lb. surface casing was set to 798 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 800 ft. to 5,670 ft., and 9⅝ in. 40-lb. and 36-lb. casing was set to 5,644 ft. and cemented to 2,730 ft. Eight and five-eighths-inch hole was drilled from 5,670 ft. to 8,542 ft.

Nineteen conventional cores were cut between 2,490 ft. and 8,542 ft., coring in all 193 ft. Seventeen cores, of total length 118 ft. 9½ in. were recovered (61·6 per cent. recovery). Twenty-seven sidewall cores were taken between 1,103 ft. and 1,926 ft. Wireline logging was carried out by Welex. Induction-Electric logs were run between 798 ft. and 8,017 ft., guard logs between 798 ft. and 8,017 ft., caliper logs between 16 ft. and 5,660 ft., radioactivity logs between 50 ft. and 8,017 ft., and acoustic velocity logs between 50 ft. and 8,016 ft. A temperature survey was run from 600 ft. to 5,610 ft. and a continuous dipmeter survey from 5,300 ft. to 8,014 ft. Deviation surveys were also run. Core Laboratories Inc. maintained a continuous gas-detection unit and logging service.

The stratigraphic section encountered was reported as—

Surface–1,353 ft.	Winton Formation	
1,353–1,826 ft.	Upper Tambo Formation	
1,826–2,472 ft.	Lower Tambo Formation	
2,472–3,386 ft.	Roma Formation	
3,386–3,633 ft.	Transition Beds	Blythesdale Group
3,633–4,330 ft.	Mooga Sandstone	
4,330–4,655 ft.	Fossil Wood Beds	
4,655–5,058 ft.	Gubberamunda Sandstone	
5,058–5,534 ft.	Lower Jurassic	
5,534–5,646 ft.	Upper Permian	
5,646–6,267 ft.	Lower Permian	
6,267–7,532 ft.	Upper Devonian	
7,532–8,212 ft.	Middle Devonian	
8,212–8,542+ft.	Lower Devonian	

The only hydrocarbon indication was a small, sharp methane increase recorded at 4,405 ft. Cuttings from this depth showed no fluorescence. Five drill-stem tests were conducted. The results are summarised below—

D.S.T.1.	3,875–4,075 ft.	Recovered fresh water
D.S.T.2.	4,374–4,422 ft.	Recovered fresh water
D.S.T.3.	5,640–5,730 ft.	Recovered water cut mud
D.S.T.4.	7,663–7,739 ft.	Recovered salt water
D.S.T.5.	8,477–8,535 ft.	Misrun

Drilling is continuing.

Smart Oil Orient No. 1

Smart Oil Orient Scout No. 1 was drilled to a depth of 1,658 ft. during 1960. The well was deepened with a larger plant during 1961 as Smart Oil Orient No. 1. Drilling was resumed on 16th January, 1961, and reached total depth of 3,200 ft. by 31st May. The drilling contractor was J. R. Robinson, using a Hydromaster 1,880 percussion plant.

Six-inch hole was drilled to 2,680 ft., when 5 in. 9.64 lb. casing was set to that depth and cemented to surface. Five-inch hole was drilled from 2,680–3,200 ft., and 4 in. 7.63 lb. casing was set to total depth, and cemented between 2,500 ft. and 2,700 ft. The hole was plugged between 3,000–3,200 ft. to control the water flow. Cores were taken at 1,800 ft., 2,005 ft., 2,040 ft., 2,260 ft., and 2,630 ft.

No detailed stratigraphic subdivision has been attempted, but lithological and palaeontological evidence suggests that the well penetrated a small thickness of Winton Formation from the surface, then marine Cretaceous rocks (Tambo and Roma Formations) to 2,220 ft., then Blythesdale Formations to total depth.

Water was met at the following depths:

2,235–2,240 ft.	in sandstone	250 g.p.h.
2,345–2,350 ft.	in sandstone	1,620 g.p.h.
2,510–2,520 ft.	in sandstone	260,000 g.p.d.
2,550–2,585 ft.	in sandstone	500,000 g.p.d.
2,630–2,640 ft.	in sandstone	750,000 g.p.d.
2,705–2,715 ft.	in sandstone	450,000 g.p.d.
2,745–2,755 ft.	in sandstone	1,000,000 g.p.d.
3,140–3,200 ft.	in sandstone	750,000 g.p.d.

Gas was reported at 2,235–2,240 ft., 2,260–2,270 ft., 2,345–2,350 ft., 2,550–2,585 ft. and 2,880–2,910 ft., all in sandstone. Analysis of the gas at 2,240 ft., showed it to consist almost entirely of hydrogen, inerts and methane. The gas at 2,910 ft. consisted dominantly of methane and ethane. A trace of oil was reported at 2,740 ft. in mudstone.

The hole was abandoned on 9th June, 1961, and converted to a water well to supply water for the drilling of Orient No. 2.

Smart Oil Orient No. 2

This well was situated 2½ miles east of Smart Oil Orient No. 1 (which was located at lat. 27°40′15″S., long. 143° 09′ E.), about 50 miles west-north-west from Thargomindah. It was situated on the seismically delineated Chesson Anticline and was designed to test the Mesozoic and Palaeozoic sections for hydrocarbons and also as a stratigraphic test for the Palaeozoic section. The drilling contractor was J. R. Robinson, using a Hydromaster 1880 percussion plant. Ground elevation was 426 ft., and elevation of the drilling floor 430 ft. Drilling began on 7th August, 1961, and had reached a depth of 2,130 ft. when drilling was suspended for the year on 16th December. The work was subsidised by the Commonwealth Government.

Hole size was 15 in. from surface to 120 ft., 9½ in. from 120–1,500 ft., and 7½ in. below 1,500 ft. Ten and three-quarter inch 51-lb. casing was set from surface to 120 ft., and cemented to surface; and 8 in. 23.2-lb. casing was set from surface to 1,500 ft., and cemented back 120 ft. Cores were taken at 500 ft., 1,135 ft., and 2,000 ft.

The section penetrated has not been subdivided stratigraphically, but it would appear that for the greater part of the hole marine Cretaceous rocks (Tambo and Roma Formations) were penetrated, with some Winton Formation rocks at the surface.

Salty water was encountered at 85 ft., and at 185 ft., and a flow (103 g.p.h.) of fresh water at 1,185 ft. A small gas show was recorded at 1,315 ft. in sandstone.

Drilling is continuing.

Standard Gas Cribb Island No. 1

The drilling of this well continued during 1961, and it deepened from 1,420 ft. to 2,001½ ft. The strata penetrated consisted of sandstone, shale and coal, equivalent in age to the Ipswich Coal Measures. The presence of inflammable gas was still recorded. Five-inch casing was set to 1,910 ft., and the hole capped. The company proposes to later deepen the well to basement (expected to be Brisbane Metamorphics), using a more powerful plant.

Union-Kern-A.O.G. Cabawin No. 1

This well was drilled for Union Oil Development Corp., Kern County Land Co. and Australian Oil and Gas Corp. Ltd. in Authority to Prospect 57P. It was located at lat. 27°28′16″S., long. 150°11′19″E., about 20 miles south-west of Tara. It was drilled as a structural test on a domal feature delineated by seismic methods.

The drilling contractor was Oil Drilling and Exploration Ltd., using a National 80B drilling rig. The well was spudded on 6th October, 1960, and total depth of 12,035 ft. was reached on 26th March, 1961. Ground elevation was 951.4 ft. (before grading) and the kelly bushing elevation (the datum level) was 968.2 ft. The work was subsidised by the Commonwealth Government.

Hole size was 17½ in. from surface to 622 ft., 12¼ in. from 622-5,413 ft. and 8¾ in. from 5,413 ft. to total depth. Thirteen and three-eighths inch 48-lb. casing was set to 591 ft., 9⅝ in. 36-lb. casing to 3,047 ft. and 5½ in. 17-lb. and 20-lb. casing to 12,033 ft.

Forty-three conventional cores were taken between 562 ft. and 11,783 ft., and Schlumberger took 149 sidewall cores between 1,189 ft. and 11,958 ft. Electric logs were run by Schlumberger from 591–11,773 ft., micrologs from 591–12,027 ft. laterologs from 6,500–12,026 ft. and a gamma ray-neutron log from 3,000–11,993 ft. Dipmeter surveys were taken from 4,124–11,648 ft. and velocity surveys from 600–12,033 ft. A gas-detection unit was operated by Rotary Engineering Company from 1,278 ft. to total depth.

The following stratigraphic sequence was reported:— (Measurements from K.B., 18 ft. above ground level)

Surface– 60 ft.	Cenozoic sediments
60– 2,865 ft.	Roma Formation
2,865– 4,200 ft.	Blythesdale Formation
4,200– 5,444 ft.	Walloon Formation
5,444– 7,640 ft.	Bundamba Formation
7,640– 9,835 ft.	Cabawin Formation
9,835–10,357 ft.	Kianga Formation
10,357–11,662 ft.	Back Creek Formation
11,662–12,035 ft.	Cracow Formation

The Cabawin Formation has been defined by Union Oil Development Corp. "to include a monotonous sequence of coarse clastic conglomerates composed of volcanic detritus . . . demonstrated to be equivalent in outcrop to units previously mapped as Moolayember, Clematis, Rewan and part of the upper Bowen Group." A Triassic age has been assigned on the basis of the fossil microflora.

The drilling of this well confirmed the presence of hydrocarbons in the Surat Basin, significant oil and gas shows being encountered in the Bundamba, Cabawin, Kianga, Back Creek and Cracow Formations. The hydrocarbon indications are summarised—

Bundamba Formation . .	Significant oil and gas shows
Cabawin Formation . .	Minor gas shows
Kianga Formation . .	An eight ft. oil zone (9,928-9,936 ft.) and other significant oil and gas shows
Back Creek Formation . .	Minor gas shows
Cracow Formation . .	Significant gas shows

The Back Creek Formation is considered to be the primary source section.

Two open hole tests were made in the Bundamba Formation, at 6,728–6,776 ft. and at 7,388–7,406 ft., but both tested wet or tight. A number of intervals within the Cabawin Formation were tested through 5½-in. casing, with the following zones testing wet or tight:—8,508–8,520 ft., 8,532–8,540 ft., 8,549–8,557 ft., 8,752–8,760 ft., 8,762–8,770 ft., 8,774–8,786 ft. and 8,878–8,890 ft. The primary oil zone was encountered in tuffaceous sandstones of the Kianga Formation. The following perforated intervals were tested within this formation:— 9,925–9,943 ft., 9,965–9,973 ft., 9,998–10,012 ft., 10,152–10,158 ft. and 10,166–10,172 ft. After 22 days of continuous production the well was producing 49 A.P.I. gravity crude at the rate of 62 barrels/day and 534 mcf/day of gas. During the total testing period 1,761 barrels of crude and 13,744 mcf. of gas were produced. Two zones were perforated and tested in the Cracow Formation: 11,744–11,750 ft., 11,752–11,760 ft., and 11,881–11,995 ft. Both tests produced salt water.

Cement plugs were set at 12,003–12,033 ft., 11,811–11,996 ft. and 10,484–10,838 ft. The well was equipped with 2-in. tubing to 9,903 ft., and was shut in on 17th June, 1961.

Union-Kern-A.O.G. Cabawin East No. 1

This well was located at lat. 27°29′10″S., long. 150°15′15″E. It was designed as a structural test of the oil-bearing Permian section encountered in the drilling of U.K.A. Cabawin No. 1. It occupied a flank position relative to the West Cabawin closure, but was separated from this feature by a major north-east trending fault. The drilling contractor was Oil Drilling and Exploration Ltd., using a National 80B rig. Ground elevation was 993 ft., and kelly bush elevation 1,010 ft. The well was spudded on 18th July, 1961, and total depth of 12,091 ft. was reached on 14th October, 1961. The work was subsidised by the Commonwealth Government.

Hole size was 17½ in. to 1,990 ft., 12¼ in. to 2,565 ft. and 8¾ in. to total depth. Thirteen and three-eighths inch 48-lb. casing was set to 1,972 ft. and cemented.

Seven conventional cores were taken between 6,715 ft. and 10,699 ft., coring 66½ ft., and recovering 56½ ft. (or 85 per cent.). Forty-one sidewall cores were recovered between 6,762–12,085 ft. Schlumberger ran electric logs between 1,972–12,091 ft., and sonic logs between 1,972–12,091 ft. An automatic gas-detection unit was maintained.

The company reported the stratigraphic succession to be—

Surface– 2,825 ft.	Roma Formation
2,825– 4,162 ft.	Blythesdale Formation
4,162– 5,295 ft.	Walloon Formation
5,295– 7,850 ft.	Bundamba Formation (consisting of an upper sandstone section, a middle shale section and a lower sandstone section)
7,850–10,600 ft.	Cabawin Formation
10,600–11,198 ft.	Kianga Formation
11,198–12,091+ft.	Back Creek Formation

No oil or gas shows were recorded. Blue fluorescence was noticed in sandstones between 6,370–10,515 ft., in conglomerate between 10,547–10,600 ft., and in sandstone between 10,640–11,090 ft. Yellow and golden fluorescence was noticed in tuff, siltstone and tuffaceous shale between 11,340–11,900 ft. Fluorescence below 11,900 ft. to total depth is considered mineral fluorescence.

Cement plugs were set between 9,768–9,968 ft., 4,785–4,985 ft. and 2,295–2,435 ft., and the well leased to the property owner as a water well.

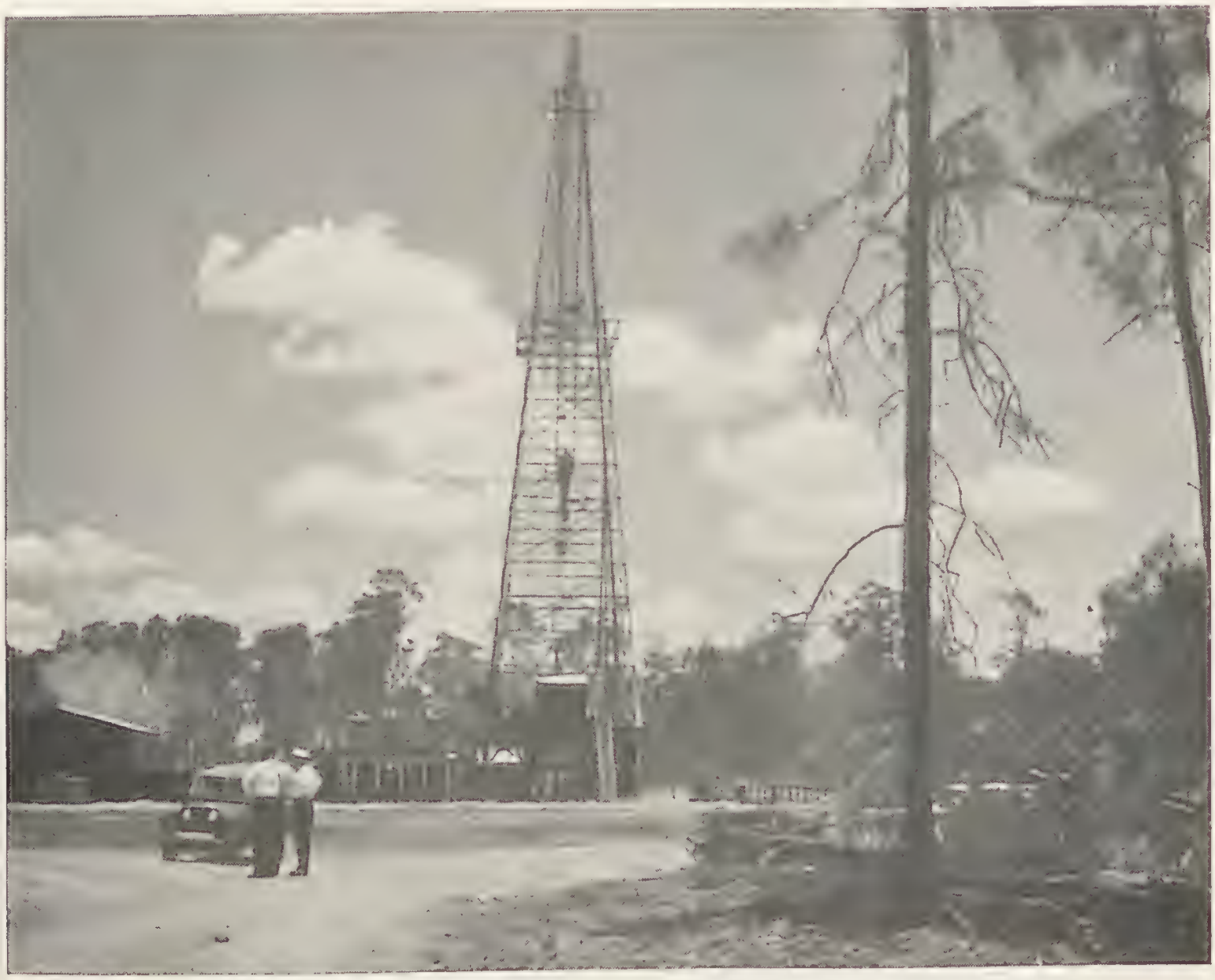
Union-Kern-A.O.G. Moonie No. 1

This well was located at lat. 27°44′30″S, long 150°15′25″E, about 35 miles south-south-west of Tara. The well was designed to test the Bundamba Formation (which had been recognized in the Cabawin area to be a favourable reservoir section) on the Moonie Anticline, a seismically delineated structure. This structure is a domal feature, being a closure on the flank of a plunging fold in Mesozoic rocks, overlying a steeply-dipping, truncated and faulted Permian section.

The drilling contractor was Oil Drilling and Exploration Ltd., and the rig a National 80B. Ground elevation was 870 ft., and kelly bush elevation 887 ft. The well was spudded on 12th November, 1961, and reached total depth of 6,106 ft. on 3rd December. The work was subsidised by the Commonwealth Government.

Hole size was 17½ in. from surface to 1,651 ft., 12¼ in. from 1,651–2,851 ft., and 9⅞ in. from 2,851 ft. to total depth. Thirteen and three-eighths inch 48-lb. casing was set to 1,636 ft. and cemented; 5½ in. 17-lb. and 20-lb. casing was set to 5,950 ft. and cemented, and a cement plug was set at 5,910 ft.

Seven conventional cores were cut, between 4,795-6,106 ft., coring 42 ft. Four cores were recovered, for a total recovery of approximately 50 per cent. Forty-two sidewall cores were recovered between 4,188–6,090 ft. Schlumberger ran electric logs between 1,636–6,105 ft., micrologs



Union-Kern-Australian Oil and Gas Moonie No. 1 Well—National 80 B Drilling Rig.
—Photo. courtesy Union Oil Development Corporation.

between 3,600–6,106 ft., laterologs between 4,500–6,104 ft., gamma ray logs between 0–5,906 ft., sonic logs between 1,636–6,090 ft. and a continuous dipmeter survey between 1,636–6,078 ft. A temperature log was run from surface to 5,100 ft. An automatic gas-detection unit was maintained.

The stratigraphic succession was reported to be—

Surface–2,399 ft.	Roma Formation
2,399–3,540 ft.	Blythesdale Formation
3,540–4,558 ft.	Walloon Formation
4,558–5,895 ft.	Bundamba Formation (consisting of an upper sandstone section, a middle shale section and a lower sandstone section)
5,895–6,046 ft.	Lower Triassic fill deposit (equivalent to Cabawin Formation)
6,046–6,106 ft.	Kuttung Formation (Volcanics)

Blue fluorescence was observed in sandstone at intervals between 4,600–5,900 ft. Oil odour was noticed at 4,698 ft., and at intervals between 5,640–5,868 ft. Oil staining was noted at 5,828 ft.

An open hole formation test was made over the interval 5,816–5,925 ft. The well flowed at the rate of 250 barrels/day oil (48° API), 250 barrels/day water and 200 mcf/day gas. Production tests were made through jet perforations in the 5½-in. casing, at 5,840 ft., at 5,808–5,814 ft., 5,818–5,840 ft. and at 5,650 ft. The results are summarized as—

5,840 ft. (packer at 5,821 ft.)	1,440 bbls/day oil (48° API); 100 mcf/day gas.
5,808–5,814 ft., 5,818–5,840 ft. (packer at 5,791 ft.)	1,765 bbls/day oil (47° API); 175 mcf/day gas.
5,650 ft. (packer at 5,634 ft.)	gas cut mud, clean oil (54° API) and emulsion.

Towards the end of December, 1961, the 5½-in. casing was jet perforated between 5,798 ft. and 5,840 ft., 2⅜-in. tubing inserted to 5,779 ft., and the Christmas Tree installed. The well produced at the rate of 2,196 barrels/day oil (48° API) and 200 mcf/day gas.

Testing is continuing.

APPENDIX

CORRELATION OF THE MESOZOIC STRATA OF THE SURAT BASIN

By R. J. ALLEN, Geologist

Recent stratigraphical studies by Union Oil Development Corporation and Mines Administration Pty. Ltd., and palynological studies by the Bureau of Mineral Resources and the Queensland Mines Department, have revealed errors in the previously accepted correlation of the Mesozoic strata of the Roma wells with those cropping out in the Roma-Rolleston region. (Traves and Thralls, 1960; G.S.Q., 1961a).

Major contributions to the published knowledge of the Mesozoic section in the Roma-Rolleston area have been made by Jensen (1926; 1961) and Reeves (1947). The nomenclature most generally used is that of Whitehouse (1955) after Reeves (1947)—

Roma Formation
Blythesdale Group
Walloon Coal Measures
Marburg Formation
Bundamba Group { Boxvale Sandstone / Evergreen Shale / Precipice Sandstone }
Moolayember Shale
Clematis Sandstone

Mines Administration Pty. Ltd. (Traves and Thralls, 1960; Traves, 1962) divides the Mesozoic section met in the Roma wells as follows:—

Roma Formation
Blythesdale Formation
Walloon Coal Measures
Bundamba Sandstone
Moolayember Formation
Wallumbilla Beds ?
Pickanjinnie Formation (Permian-Triassic)

A similar division was used in Geological Survey Publication No. 299 and its First Supplement (G.S.Q., 1961a, b).

Union Oil Development Corporation, in unpublished reports to the Department, has divided the Mesozoic section met in its Cabawin No. 1 and Cabawin East No. 1 wells as follows:—

Roma Formation
Blythesdale Formation
Walloon Formation
Bundamba Formation { upper member / middle member / lower member }
Cabawin Formation (Permian-Triassic)

It correlates the Cabawin and Bundamba Formations as follows:—

Cabawin Wells	Roma Wells	Roma–Rolleston Outcrop
Upper Bundamba ..	Bundamba Sandstone	Marburg Formation Boxvale Sandstone
Middle Bundamba Lower Bundamba	Moolayember Formation	Evergreen Shale Precipice Sandstone
Cabawin Formation	Pickanjinnie Formation	Moolayember Shale Clematis Sandstone Rewan Formation

Jensen (1961) from extensive field and well-site experience in the Roma district during the 1920's and early 1930's, correlates the bottom sedimentary strata of the Roma wells with his Lower Walloon (?Walloon Coal Measures of Whitehouse, 1955).

Stratigraphical studies by the Geological Survey appear to confirm the Union Oil Development Corporation correlations.

Mines Administration Pty. Ltd. from palynological studies principally by the Bureau of Mineral Resources, exchange of information with Union Oil Development Corporation, and its own extensive stratigraphical studies, is aware of the probable invalidity of its present correlations, but prefers to retain them until the correct correlations are fully established (Traves, 1962).

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QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

Third Supplement to
Geological Survey Publication No. 299
"OCCURRENCE OF PETROLEUM AND NATURAL GAS IN QUEENSLAND"
1961

PETROLEUM EXPLORATION IN QUEENSLAND DURING 1962

PETROLEUM PROSPECTING
By I. W. MORLEY, State Mining Engineer
and
A. H. BASIRE, Petroleum Technologist

DRILLING RESULTS
By I. G. SANKER, Geologist

BRISBANE
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PETROLEUM EXPLORATION IN QUEENSLAND DURING 1962

PREFACE

Publication No. 299 of the Geological Survey of Queensland—"Occurrence of Petroleum and Natural Gas in Queensland"—dealt with the search for petroleum in Queensland to the end of 1959. To keep this publication up to date, it was decided to issue as a supplement each year, a reprint of the section of the Annual Report of the Department of Development and Mines relating to petroleum exploration. This reprint is the third supplement.

PETROLEUM PROSPECTING

By I. W. MORLEY, State Mining Engineer

and

A. H. BASIRE, Petroleum Technologist

Part 1—Prospecting Titles Held.
Part 2—Exploration (General).
Part 3—Drilling.
Part 4—Employment and Accidents.
Part 5—Legislation.
Part 6—General.

PART 1—PROSPECTING TITLES HELD

Figure 1 shows the location of petroleum prospecting titles as at 31st December, 1962. These number 38 and comprise 33 Authorities to Prospect and 5 Prospecting Petroleum Permits. The total area held under title at the above date was 880,930 square miles being 880,030 square miles held under Authorities to Prospect and 900 square miles under Prospecting Petroleum Permits. The number of titles held on 31st December, 1962, shows an increase of 5 over those held and applied for on 31st December, 1961, while on 31st December, 1962, two non-prospective areas were vacant. Apart from these vacant areas, the entire State was covered by prospecting titles at the end of 1962. As areas become vacant through compulsory surrenders, or termination of titles, the tendency will be for title areas to become smaller and the numerical strength of titles to become larger. This trend is a healthy one and has already become apparent as shown above.

Table A sets out the status of petroleum prospecting titles as at 31st December, 1962, and Table B lists surrenders which took place during the year.

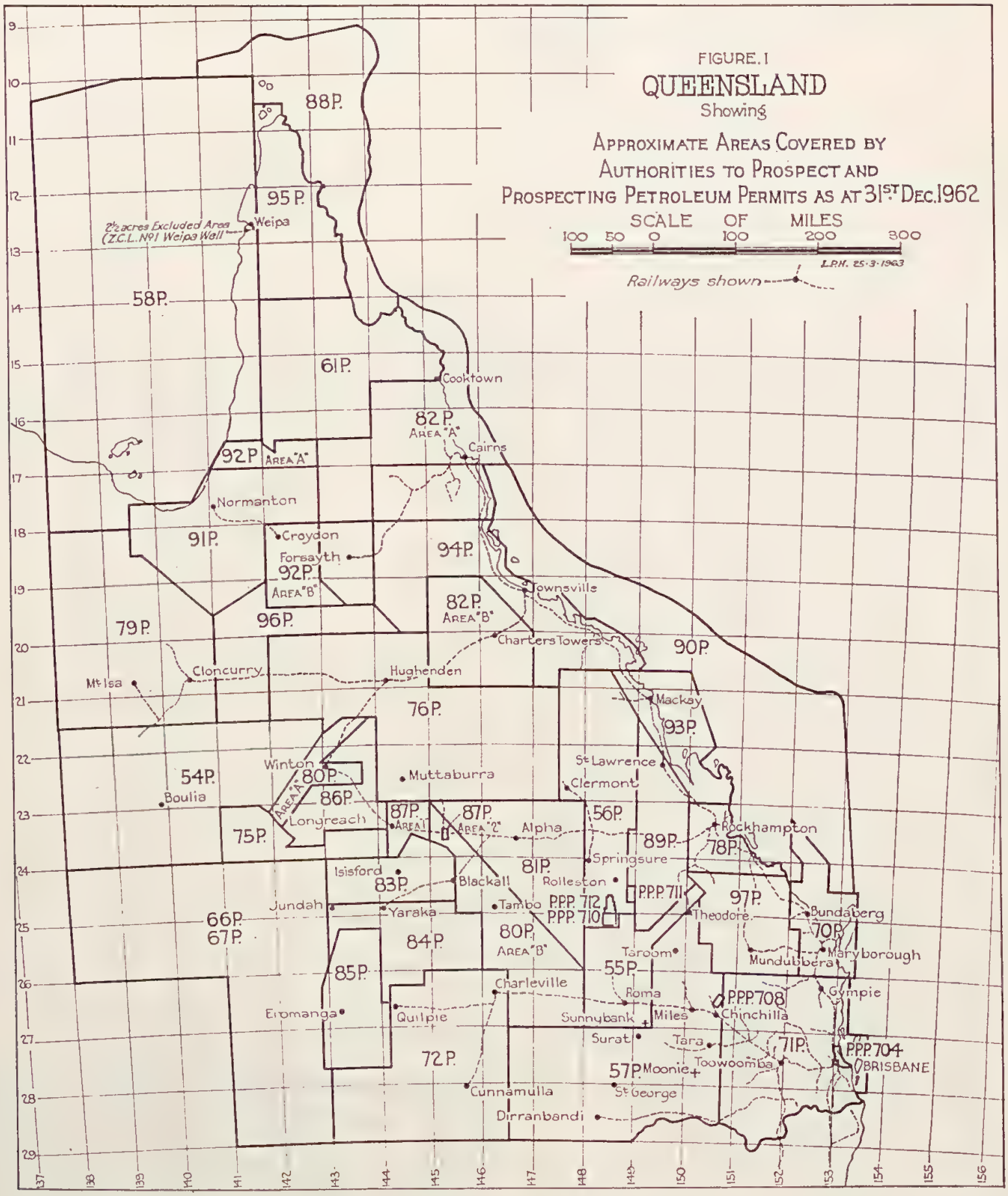


FIGURE. I
QUEENSLAND
Showing
APPROXIMATE AREAS COVERED BY
AUTHORITIES TO PROSPECT AND
PROSPECTING PETROLEUM PERMITS AS AT 31ST DEC. 1962
SCALE OF MILES
100 50 0 100 200 300
L.P.H. 25-3-1963
Railways shown
88P.
95P.
2½ acres Excluded Area (Z.C.L. N91 Weipa Well
Weipa
58P.
61P.
Cooktown
82P. AREA "A"
92P AREA "A"
Cairns
Normanton
91P.
Croydon
Forsayth
92P. AREA "B"
94P.
Townsville
82P. AREA "B"
79P.
96P.
Charters Towers
90P.
Cloncurry
Mt Isa
Hughenden
76P.
Mackay
93P.
St Lawrence
Winton
80P. AREA "A"
54P.
Muttaburra
Clermont
Boulia
86P.
87P. AREA 1
87P. AREA "2"
56P.
Longreach
75P.
Alpha
Rockhampton
89P.
78P.
Springsure
81P.
Isisford
83P.
Blackall
Rolleston
P.P.P. 711
97P.
Jundah
Tambo
P.P.P. 712
P.P.P. 710
Yaraka
Theodore
Bundaberg
66P.
67P.
84P
80P. AREA "B"
70P.
Taroom
Maryborough
Mundubbera
85P.
55P.
Charleville
Roma
Gympie
P.P.P. 708
Eromanga
Quilpie
Sunnybank
Miles
Chinchilla
Surat
Tara
71P.
P.P.P. 704
72P.
57P.
Moonie
Toowoomba
BRISBANE
Cunnamulla
St George
Dirranbandi

Table A

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
	Sq. Miles			
		PROSPECTING PETROLEUM PERMITS		
P.P.P. 704	200	Standard Gas Pty. Ltd., L. G. Neill, Managing Director, 307 Queen Street, Brisbane	Brisbane	Drilling
P.P.P. 708	100	Condamine Oil Limited, R. Swinton, Managing Director, Box 761K, G.P.O., Brisbane; J. Kooy, Driller in Charge, Auburn Road, Chinchilla	North of Chinchilla ..	Drilling
P.P.P. 710*	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South of Springsure	Geological and Geophysical Investigations
P.P.P. 711*	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South-East of Springsure	
P.P.P. 712*	200	Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 26 O'Connell Street, Sydney	South of Springsure	
Total ..	900	Square Miles.		
		AUTHORITIES TO PROSPECT		
54P† ..	43,000	The Papuan Apinaipi Petroleum Company Limited, G. H. R. Jones, Chairman, 53 Martin Place, Sydney; D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane	Boulia	Drilling activities
55P† ..	11,570 Amalgamated	Associated Australian Oilfields No Liability, E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane	Roma–Theodore	Exploration Surveys and Drilling
56P† ..	22,900	Associated Freney Oil Fields No Liability, E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane	Clermont–Mackay	
57P ..	43,000	Union Oil Development Corporation, and Kern County Land Company. In this area Australian Oil and Gas Corporation Limited have a reserved interest. Operator—Union: A. C. Rubel, President, Union Oil Centre, Los Angeles, California, U.S.A.; D. Graves, Resident Manager, Box 5048, G.P.O., Sydney; D. Pyle, Field Superintendent, P.O. Box 270, Toowoomba	St. George–Miles ..	Exploration Surveys and Drilling and Development Drilling
58P ..	137,000	Santos Limited (50 per cent.) and Delhi Australian Petroleum Ltd. (50 per cent.). Santos: J. E. Klug, Chief Executive Officer, Mutual Life Chambers, 44 Grenfell Street, Adelaide, South Australia. Delhi: W. Clifford Smith, Vice President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837P, G.P.O., Adelaide, South Australia. Operator—Delhi	Gulf of Carpentaria ..	Aeromagnetometrics
61P ..	28,000	Marathon Petroleum Australia Ltd., E. B. Shade, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. R. Loose, Exploration Manager, Box 687K, G.P.O., Brisbane A portion of this title is subject to an agreement between Cabot Corporation, Blueberry Oil Corporation and Curran R. Campbell Incorporated and Associated Australian Oilfields No Liability. Operator—Cabot Corporation, G. Martin, Superintendent, care of C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Laura Basin	Exploration Drilling
66P ..	33,800 Checkerboarded and Interrelated	Santos Limited, J. E. Klug, Chief Executive Officer, Mutual Life Chambers, 44 Grenfell Street, Adelaide, South Australia	Haddon Corner, Qld.–S.A. Border	Geological and Geophysical Surveys and Exploration Drilling
67P ..	33,800	Delhi Australian Petroleum Ltd., W. Clifford Smith, Vice President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837P, G.P.O., Adelaide, South Australia. Operator—Delhi		

Table A—continued

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
70P ..	10,000	Pacific American Oil Company with whom are associated in this area Shell Development (Australia) Proprietary Limited. Pacific American; J. Abernathy, President, Box 8837, Oklahoma City, Oklahoma, U.S.A. C. W. Siller, Vice President, 134 Adelaide Street, Brisbane. Operator—Shell; Lewis Luxton, Chairman, T. H. van der Harst, Senior Geologist, Shell Corner, 155 William Street, Melbourne, C.1, Victoria	Maryborough–Bundaberg	Geological and Geophysical Surveys
71P ..	29,500	Queensland American Oil Company (25 per cent.) and Sunray D.X. Oil Company (37½ per cent.) and Phillips Petroleum Company (37½ per cent.). Operator—Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 124, P.O., North Quay, Brisbane	Gympie – Brisbane – Toowoomba	Photogeology, Seismic Surveys and Exploration Drilling
72P ..	35,000	Sunray D.X. Oil Company (50 per cent.) and Phillips Petroleum Company (50 per cent.). Operator—Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 124, P.O., North Quay, Brisbane	Charleville	Seismic Surveys
75P ..	8,300	Amerada Petroleum Corporation of Australia Limited, Continental Oil Company of Australia Limited and Marathon Petroleum Australia Ltd. (Equal shares). Operator—Marathon: E. B. Shade, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. R. Loose, Exploration Manager, Box 687K, G.P.O., Brisbane	West of Longreach ..	No Field Work
76P ..	48,000	Exoil No Liability. C. W. Siller, Chairman, 134 Adelaide Street, Brisbane; L. W. Doggett, Secretary, Box 281D, G.P.O., Brisbane	Hughenden	Geophysical Surveys and Exploration Drilling
78P ..	6,000	Nortex Australian Oils Ltd., J. R. Wendover, President, 1900 Life Building, Dallas 2, Texas, U.S.A.; F. N. Hanlon, Consulting Geologist, 4 Pearson Avenue, Gordon, New South Wales	Rockhampton	Exploration Drilling
79P ..	40,000	Amalgamated Petroleum Exploration Pty. Limited, A. R. Dodson, Executive Director, Box 4721, G.P.O., Melbourne; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cloncurry–Mount Isa ..	Some Field Geology
80P‡	Area A 5,000	Magellan Petroleum (Qld.) Pty. Ltd. (75 per cent.) and Central Queensland Petroleum Coy. Pty. Ltd. (25 per cent.). Magellan: T. S. M. Ranneft, Director, Box 455F, G.P.O., Brisbane. Central Queensland: R. F. G. Wilson, Agent, Box 1555V, G.P.O., Brisbane.	Winton	Geological and Geophysical Surveys
	Area B 18,000	Magellan Petroleum (Qld.) Pty. Ltd., T. S. M. Ranneft, Director, Box 455F, G.P.O., Brisbane	Tambo	
81P ..	19,500	Oil Development N.L.: H. B. Borwick, Managing Director, 11th Floor, 100 Collins Street, Melbourne; L. W. Doggett, Agent, Box 281D, G.P.O., Brisbane	Alpha	Seismic Surveys and Exploration Drilling
82P ..	Area A 24,500 Area B 15,450	Triton of Australia Ltd.: C. H. Green, Director, care of North Star Oil Corporation, 1007 Midland Savings Buildings, Midland, Texas, U.S.A.; L. Brundall, Australian Exploration Representative, 30–36 Herschel Street, Brisbane	Cairns	Some Field Geology
83P ..	9,300	Amerada Petroleum Corporation of Australia Limited, Continental Oil Company of Australia Limited, Marathon Petroleum Australia Ltd. (Equal shares). Operator—Marathon: E. B. Shade, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. R. Loose, Exploration Manager, Box 687K, G.P.O., Brisbane	Isisford	No Field Activities
84P ..	13,500	Sunray D.X. Oil Company (50 per cent.) and Phillips Petroleum Company (50 per cent.). Operator—Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 124, P.O., North Quay, Brisbane	Yaraka	Seismic Surveys and Exploration Drilling

Table A—continued

Nos.	Area	Titleholders and Names and Addresses of Principal Officers	Locality	State of Operations
85P ..	11,900	L. H. Smart Oil Exploration Co. Limited, L. H. Smart, Chairman, Box 2670, G.P.O., Sydney; R. C. Sprigg, Geological Consultant, Box 1479L, G.P.O., Adelaide, South Australia (This title is being conditionally surrendered and as from 1st January, 1963, two Authorities to Prospect will issue in its stead to L. H. Smart Oil Exploration Co. Limited)	Eromanga	Exploration Drilling
86P† ..	9,300	Associated Australian Oilfields No Liability, E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane	West of Longreach ..	Seismic Surveys and Exploration Drilling
87P ..	Area No. 1 2,700 Area No. 2 90	Longreach Oil Limited, J. McD. Royle, Managing Director, Box 775, G.P.O., Sydney; W. D. Mott, Consulting Geologist, Astor Court, corner of Wharf and Leichhardt Streets, Brisbane (Area No. 2 is subject to an agreement with Farmout Drillers No Liability, Hare & Associates, General Manager, 20 Collins Street, Melbourne)	Ilfracombe	Seismic Surveys
88P ..	31,000	Gulf Interstate Overseas Ltd., W. J. Steeger, President, 1702 Esperson Building, Houston, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Torres Strait	Aeromagnetometrics
89P ..	13,100	Marathon Petroleum Australia Ltd. and Continental Oil Company of Australia Limited. (Equal shares). Operator—Marathon: E. B. Shade, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. R. Loose, Exploration Manager, Box 687K, G.P.O., Brisbane	Baralaba – Duaringa – St. Lawrence	Geological and Seismic Surveys
90P ..	57,000	Australian Oil and Gas Corporation Limited, T. W. H. Dee, Managing Director, Box 5048, G.P.O., Sydney; T. H. Koch, Exploration Manager, Box 5048, G.P.O., Sydney	Great Barrier Reef ..	Aeromagnetometrics
91P ..	25,000	Mid-Wood Exploration Pty. Ltd., Rees B. Withers, Managing Director, 792 Elizabeth Street, Melbourne, C.1; J. F. FitzGerald, Secretary, Box 535H, G.P.O., Brisbane	Normanton	Geological Surveys and Aeromagnetometrics
92P ..	Area A 4,000 Area B 7,200	Petroleum Exploration Incorporated, Tulane Gordon, President, 1501 Millie Esperson Buildings, Houston 2, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Croydon	No Field Surveys
93P .. (To issue)	11,770	Ampol Exploration (Q'land.) Pty. Limited, A. Wark, Manager; S. Nasr, Exploration Manager, Buchanan Street, Balmain, New South Wales	Mackay	Geological Surveys
94P ..	26,050	Ampol Exploration (Q'land.) Pty. Limited, A. Wark, Manager; S. Nasr, Exploration Manager, Buchanan Street, Balmain, New South Wales	Ingham–Bowen	Geological Surveys
95P ..	17,900	Inland Industries Incorporated, M. Mizel, President, 802 Kennedy Building, Tulsa, Oklahoma, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Cape York Peninsula ..	No Field Surveys
96P ..	14,500	Australian Oil Corporation, Lloyd E. Innerarity, President, Midland Savings Building, Midland, Texas, U.S.A.; W. D. Mott, Consulting Geologist, Astor Court, corner of Wharf and Leichhardt Streets, Brisbane	Julia Creek	Geological Surveys
97P ..	13,400	Amalgamated Petroleum Exploration Pty. Limited, A. R. Dodson, Executive Director, Box 4721, G.P.O., Melbourne; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Monto	Geophysical Surveys and Photogeology
Total Area	880,030	Square Miles.		

* In respect of P.P.Ps. 710, 711 and 712, these titles are being conditionally surrendered and an Authority to Prospect (100 P) issued in their stead commencing on 1st January, 1963.

† In these areas 54P, 55P, 56P and 86P, Associated Australian Oilfields No Liability, Associated Freney Oil Fields No Liability, The Papuan Apinaipi Petroleum Company Limited, Associated Continental Petroleum No Liability, Interstate Oil Limited, and H. C. Sleigh Limited are jointly associated.

In respect of 54P, Phillips–Sunray (for details of Company Names and Principal Officers, *see* 72P and 84P) have an option over 50 per cent. of this area on a checkerboard basis and in pursuance of this option Phillips are the present operators. In respect of 55P, 56P, and 86P the operators are subsidiary companies, Petroleum Exploration Company (Petexco) in association with Mines Administration Pty. Ltd.: E. N. Avery, Managing Director, D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane.

‡ In respect of this title, California Asiatic Oil Company (Calasiatic) and Texaco Overseas Petroleum Company (Topco) have an option over 50 per cent. and are directing exploration on this area. The operating Company for Calasiatic and Topco is American Overseas Petroleum Limited. (Amoseas): O. F. van Deveren, President, 485 Lexington Avenue, New York, U.S.A., E. R. Locke, Manager, Exploration Operations, Australia, Box 1086N, G.P.O., Brisbane.

Table B

Title No.	Holder	Locality	Remarks
61P	Plymouth Oil Company	Cape York Peninsula	Northern portion surrendered to become 95P
78P	Nortex Australian Oils Ltd.	Rockhampton–Mundubbera ..	Southern portion surrendered to become 97P
82P	Triton of Australia Ltd.	Cairns–Townsville	Central portion surrendered and partly taken up as 94P. Remainder vacant

PART 2—EXPLORATION (GENERAL)

The following details of work done during 1962 have been obtained from title holders. In addition work done by Government agencies is described.

Prospecting Petroleum Permits

P.P.P. 704.—Drilling Cribb Island No. 1 Well, also drilled Boondall Scout No. 1 and Cribb Island Scout No. 11.

P.P.P. 708.—Drilling C.O.L. No. 1 (Speculation). One month's seismic work.

P.P.Ps. 710, 711, and 712.—Geological assessment and seismic surveys of nine months duration over the entire area. Titles surrendered and re-issued on 1st January, 1963, as Authority to Prospect 100P.

Authorities to Prospect

54P.—No geological or geophysical activities. Four stratigraphic wells drilled by Phillips Petroleum Company as operators on behalf of Phillips-Sunray who have an option over 50 per cent. of the area on a checkerboard basis. The wells, Phillips-Sunray Black Mountain No. 1, Canary No. 1, Beantree No. 1, and Elizabeth Springs No. 1 were all drilled in the Boulia District and abandoned as dry holes.

55P and 56P.—Amalgamated Authorities. An intensive programme of geophysical surveys and exploration drilling has been carried out on this title. A total of 40 party months seismic work was carried out and ten wells were drilled, completed or commenced during the year. Of these wells, A.A.O. Glentulloch No. 1 (tested in 1961), A.A.O. Westgrove No. 2, and Westgrove No. 3 are possible gas producers, while A.A.O. Sunnybank No. 1 on a drillstem test over a period of 86 minutes produced a light oil at the rate of 600 barrels per day in mid-December.

57P.—A vigorous programme of exploration development has been pursued with very gratifying results. Following the successful testing of the discovery well U.K.-A.O.G. Moonie No. 1, a further 10 development wells, all potential oil producers, have been drilled on the Moonie structure in 1962 thus establishing the existence of a promising oilfield. The operators have indicated their confidence in the ability of the field to produce commercial quantities of petroleum by announcing their intention to build a pipeline to Brisbane, which it is anticipated will be in operation at the beginning of 1964. In addition to the Moonie development wells, a further 8 exploration wells were drilled or commenced during the year. Surveys carried out comprised geological, (both field work and office studies), geophysical, including magnetometric (2 party months), and seismic (32 party months).

58P.—An airborne magnetic survey comprised the only field work carried out over this title.

61P.—One well, Cabot-Blueberry Marina No. 1 was drilled on this title, and was completed as a dry hole. The title has been split into two, the northern portion now being 95P, while the southern portion (61P) is held by Marathon Petroleum Australia Ltd.

66P and 67P.—Work performed on this title included a short geological survey together with geophysical surveys comprising gravity (one party month) and seismic (6 party months) work, also the drilling of one exploration well, Delhi-Santos Orientos No. 1, completed as a water well.

70P.—Field geology, photogeology, and magnetometrics were carried out over this area.

71P.—A vigorous programme of exploration was undertaken. Work performed included photo-geology, seismic surveys (21 party months) and the drilling of 3 exploration wells namely Phillips-Sunray-Queensland American Durabilla No. 1, Phillips-Sunray-Queensland American Kogan No. 1 and Phillips-Sunray-Queensland American Kogan South No. 1, all completed as dry holes.

72P.—Seismic surveys of some 3 party months' duration comprised the extent of exploration activities on this title.

75P.—Office studies only were carried out.

76P.—Geophysical surveys were made comprising magnetometrics (1 party month) and seismic (8 party months). In addition one exploration well, Exoil Brookwood No. 1 was completed as a dry hole.

78P.—Exploration drilling was carried out, the two wells Nortex Jambin No. 1 and Nortex Jambin No. 2 being completed as dry holes. The title has been divided into two and the southern half taken up by Amalgamated Petroleum Exploration Pty. Ltd. (see 97P).

79P.—This title was taken over during the year by Amalgamated Petroleum Exploration Pty. Ltd. The only work performed has been geological and geophysical review work, and field reconnaissance.

80P.—Work performed included geological surveys (2¼ party months) and geophysical surveys (5 party months' seismic). Four months photogeological work was also carried out.

81P.—Exploration activities comprised seismic surveys (5½ party months) and exploration drilling (the Oil Development Maranda No. 1 well).

82P.—This title was reshaped during the year resulting in a large vacant area and a new title (94P) emerging from the old Authority. Work carried out included field geology (1 party month), also office and photogeology.

83P.—Office studies only.

84P.—Seismic surveys of 7½ party months' duration, and exploration drilling were carried out on this area. The well Phillips-Sunray Etonvale No. 1 was completed and Phillips-Sunray Gumbardo No. 1 was drilled.

85P.—Exploration drilling was carried out with the completion of the well Smart Orient No. 2.

86P.—Seismic surveys of 1 party month's duration, and exploration drilling (Associated Australian Oilfields Penrith No. 1 well) were carried out.

87P.—Seismic surveys (5 party months) were performed and several months geological studies were carried out.

88P.—An aeromagnetic survey of 1 month's duration and office studies were carried out.

89P.—Geological surveys (2 party months) and geophysical surveys (11½ party months' seismic) were performed on this title.

90P.—One month's aeromagnetic survey comprised the work performed on this title.

91P.—Geological surveys of 5 party months' duration and half a month aeromagnetic survey were carried out.

92P.—Aerial and surface geological reconnaissance work carried out.

93P.—Six party months' geological survey carried out.

94P.—Five party months' geological survey carried out.

95P.—Geological reconnaissance and photogeology comprised the work performed on this title.

96P.—Eight party months' geological survey were carried out on this title.

97P.—Photogeological work in both field and office was carried out, also aeromagnetic and seismic surveys (4 party months).

Regional Geological Surveys

The Bureau of Mineral Resources in conjunction with the Geological Survey of Queensland again undertook a programme of regional mapping in Queensland. Three parties were engaged in this work, 2 in the Bowen Basin and 1 in the Great Artesian Basin, geologists from the Geological Survey of Queensland being attached to each of these parties.

In addition 4 Geological Survey of Queensland parties spent in all some seven months mapping in the Bowen, Yarrol, Maryborough, and Laura basins, and a month in the Surat lobe of the Great Artesian Basin. A 3-month survey was also conducted by a Bureau of Mineral Resources party in the Laura Basin (see Table C).

Regional Geophysical Surveys

Various types of geophysical surveys were carried out in the State by the Bureau of Mineral Resources including gravity, airborne magnetometer, seismic, and radioactivity and temperature logging of water wells. Details of the surveys are shown on Tables D, E and F.

The water bore logging programme, which is sponsored by the Qupex group, the Queensland Irrigation and Water Supply Commission, the Bureau of Mineral Resources, and the Queensland Department of Development and Mines, is conducted by the Bureau of Mineral Resources and is a continuation of the project initiated in 1960 having as its objective the correlation of the upper Mesozoic section of the Great Artesian Basin, and a better understanding of the aquifers. Logging in 1962 was carried out on bores in the St. George–Roma–Augathella area over a period of some 2½ months. Four personnel were engaged (2 B.M.R. and 2 Irrigation and Water Supply Commission). Gamma ray logging was carried out on 24 bores (32,600 ft. of logging) and temperature surveys on 16 bores (22,800 ft. of logging).

Table C
GEOLOGICAL SURVEYS

Title	Operator	Party Months	Type of Survey
57P	Union Oil Development Corporation ..	7	Mapping Surat–Bowen Basins; also 4 geologists employed on subsurface basin studies, geological studies of well information and of results of geophysical surveys
		12	Geology connected with seismic surveys
66P–67P	Delhi Australian Petroleum Ltd. ..	½	Surface studies
70P	Shell Development (Australia) Proprietary Limited	3	Reconnaissance and semi-detailed, also 4 months photogeological studies
71P	Phillips Petroleum Company	..	Photogeological studies (2 months)
79P	Amalgamated Petroleum Exploration Pty. Limited	2	Reconnaissance
80P	American Overseas Petroleum Limited ..	2½	Reconnaissance Surat–Bowen–Drummond Basins
		4	Photogeology
82P	Triton of Australia Ltd.	1	Stratigraphic mapping Star Basin and Fanning River areas
		9	Photogeology
89P	Marathon Petroleum Australia Ltd. ..	2	Surface studies
91P	Mid-Wood Exploration Pty. Ltd. ..	5	Reconnaissance
93P	Ampol Exploration (Q'land.) Pty. Limited	6	Surface studies
94P	Ampol Exploration (Q'land.) Pty. Limited	5	Surface studies
96P	Australian Oil Corporation	8	Reconnaissance
97P	Amalgamated Petroleum Exploration Pty. Ltd.	1½	Photogeological studies (3 months)
	Total	68½	

NOTE.—The above return does not include geologists employed on well sitting

BY GOVERNMENT AGENCIES

Surveys conducted by the Bureau of Mineral Resources, Geological Survey of Queensland

Area of Operations	Party Months	Type of Survey
(4M Sheet Area)		
Manuka–Richmond–Hughenden (Great Artesian Basin)	5	Regional survey. Combined B.M.R./G.S.Q. party
	1½	Regional survey. G.S.Q. party
Duaringa–St. Lawrence (Bowen Basin)	5	Regional survey. Combined B.M.R./G.S.Q. party
Proserpine–Mackay–St. Lawrence (Bowen Basin) ..	5	Regional survey. Combined B.M.R./G.S.Q. party
Monto (Bowen and Yarrol Basins)	2	Regional survey. G.S.Q. party
Maryborough (Maryborough Basin)	3½	Regional survey. G.S.Q. party
Roma (Surat Sub-basin)	1	Regional survey. G.S.Q. party
Cape Melville (Laura Basin)	3	Regional survey. B.M.R. party
	1½	Regional survey. G.S.Q. party
Total	27½	

GEOPHYSICAL SURVEYS

Table D

GRAVIMETRIC

Title	Operator	Contractor	Party Months	Area Covered	Traverse Miles	Number of Stations
66P–67P	Delhi Australian Petroleum Ltd. ..	Geophysical Services International	1	Sq. Miles 576	..	174

BY GOVERNMENT AGENCIES

Surveys conducted by the Bureau of Mineral Resources, Geology and Geophysics

Area of Operations	Type of Survey	Party Months	Area Covered	Traverse Miles	Number of Stations
St. George–Thargomindah–Nocatunga ..	Regional and semi-detailed	2	Sq. Miles ..	448	418
	Total	3	576	448	592

Table E

MAGNETOMETRIC (AERIAL)

Title	Operator	Contractor	Party Months	Area Covered	Line Miles Flown
57P	Union Oil Development Corporation ..	Adastra Hunting Geophysics Pty. Limited	2	Sq. Miles 12,650	13,662
58P	Delhi Australian Petroleum Limited ..	Aero Service Limited	1	120,000	9,410
70P	Shell Development (Australia) Proprietary Limited	Aero Service Limited	¼	8,500	1,092
76P	Exoil No Liability	Adastra Hunting Geophysics Pty. Limited	1	20,372	6,970
88P	Gulf Interstate Overseas Ltd.	Aero Service Limited	½	31,000	3,294
90P	Australian Oil and Gas Corporation Limited	Aero Service Limited	1	57,000	5,545
91P	Mid-Wood Exploration Pty. Ltd.	Aero Service Limited	½	23,450	9,146
97P	Amalgamated Petroleum Exploration Pty. Ltd.	Adastra Hunting Geophysics Pty. Limited	½	5,338	4,960
		Total	6¾	278,310	54,079

BY GOVERNMENT AGENCIES

Surveys conducted by the Bureau of Mineral Resources, Geology and Geophysics

Area of Operations	Type of Survey	Party Months	Line Miles Flown
4M. Sheet areas, Mount Coolon, Mackay, St. Lawrence, Springsure, Baralaba, Jericho, Tambo	Reconnaissance/Detail	3½	18,620
Tennant Creek–Mackay, via Cloncurry	Route traverse	..	1,140
Mackay–Brisbane	Route traverse	..	506
Brisbane–Rockhampton	Route traverse	..	325
Rockhampton–Sydney	Route traverse	.. (in Queensland)	370
	Total	3½	20,961

Table F

SEISMIC

Title	Operator	Contractor	Party Months	Type of Survey	Method of Survey	Area Surveyed	Length of Sub-surface Section	Number of Shot Points	Number of Holes Drilled	Total Footage Drilled	Explosives Used	Detonators Used
						Sq. Miles	Miles				Lbs.	
P.P.P.'s 710, 711, and 712	Planet Exploration Coy. ..	Austral Geoprospectors Pty. Ltd.	8½	Reflection—Detail	Continuous profiling ..	588	350	1,590	1,814	272,084	60,095	2,375
P.P.P. 708	Condamine Oil Ltd.	Austral Geoprospectors Pty. Ltd.	1	Reflection—Detail	Continuous profiling ..	50	50	201	218	...	...	...
55P and 56P	Mines Administration Pty. Ltd.	Austral Geoprospectors Pty. Ltd.	12	Reflection—Regional and Detail	Continuous profiling and 1 mile jump correlation	3,000	720	2,896	2,949	322,260	68,220	5,902
55P and 56P	Mines Administration Pty. Ltd.	Austral Geoprospectors Pty. Ltd.	3½	Reflection—Detail	Continuous profiling ..	500	200	798	803	83,075	16,150	1,351
55P and 56P	Mines Administration Pty. Ltd.	Geophysical Services International S. A.	18	Reflection—Regional and Detail	Continuous profiling and 1 mile jump correlation	5,500	815	3,250	4,573	359,794	171,812	6,035
55P and 56P	Mines Administration Pty. Ltd.	United Geophysical Corporation	5	Reflection—Regional ..	Continuous profiling and 1 mile jump correlation	1,000	200	753	1,281	139,552	47,885	1,884
55P and 56P	Mines Administration Pty. Ltd.	Geophysical Services International S.A.	1	Refraction	In line offsets	..	50	30	78	6,922	10,943	184
57P ..	Union Oil Development Corporation	United Geophysical Corporation	17	Reflection—Reconnaissance	Continuous profiling ..	13,026	1,251	3,963	4,246	609,233	152,430	5,688
57P ..	Union Oil Development Corporation	United Geophysical Corporation	15	Reflection—Reconnaissance and Detail	Continuous profiling ..	4,381	1,043	3,255	3,343	519,433	112,374	3,935
66P and 67P	Delhi Australian Petroleum Limited	United Geophysical Corporation	4	Reflection—Reconnaissance and Detail	Continuous profiling ..	970	201	602	1,483	80,519	36,152	1,769
66P and 67P	Delhi Australian Petroleum Limited	United Geophysical Corporation	2	Refraction	..	..	368	248	294	31,125	27,410	864
71P ..	Phillips Petroleum Company	Petty Geophysical Engineering Company; Austral Geoprospectors Pty. Ltd.	21¼	Reflection	Continuous profiling ..	2,500	818	3,274	9,574	1,479,886	137,500	14,168
72P ..	Phillips Petroleum Company	Austral Geoprospectors Pty. Ltd.	2¾	Reflection	Continuous profiling ..	1,280	126	378	1,126	154,440	21,103	1,644
76P ..	Exoil No Liability	Austral Geoprospectors Pty. Ltd.	7¾	Reflection—Regional ..	Continuous profiling ..	710	355	1,420	2,556	221,005	72,455	3,453
76P ..	Exoil No Liability	Austral Geoprospectors Pty. Ltd.	¼	Refraction	..	..	23	4	51	5,410	7,010	140
80P ..	American Overseas Petroleum Limited	Petty Geophysical Engineering Company	5	Reflection	Continuous profiling ..	400	355	1,033	1,182	180,815	48,303	2,227
81P ..	Oil Development N.L. ..	General Geophysical Co. (Bahamas) Ltd.	2¾	Reflection—Reconnaissance	Split spread continuous profiling	100	89	272	327	40,590	6,760	589
81P ..	Oil Development N.L. ..	General Geophysical Co. (Bahamas) Ltd.	3½	Refraction	..	..	130	164	232	26,260	3,184	53
84P ..	Phillips Petroleum Company	Petty Geophysical Engineering Company	7½	Reflection	Continuous profiling ..	2,300	256	1,023	2,957	378,569	42,802	4,240
86P ..	Mines Administration Pty. Ltd.	Geophysical Services International S. A.	1	Reflection—Detail	Continuous profiling ..	100	30	127	134	18,220	5,380	157
87P ..	Longreach Oil Limited ..	Geoseismic (Aust.) Ltd.	4	Reflection	Continuous profiling ..	540	179	717	797	126,033	25,195	1,642
87P ..	Farmount Drillers N.L. ..	General Geophysical Co. (Bahamas) Ltd.	½	Reflection	Continuous profiling ..	60	39	120	140	16,830	2,122	197
87P ..	Farmount Drillers N.L. ..	General Geophysical Co. (Bahamas) Ltd.	½	Refraction	..	..	6	6	6	720	1,355	15
89P ..	Marathon Petroleum Australia Ltd.	United Geophysical Corporation	11½	Reflection—Reconnaissance	Continuous profiling ..	3,200	530	1,983	2,026	275,858	85,064	2,777
97P ..	Amalgamated Petroleum Exploration Pty. Ltd.	Prakla (Aust.) Pty. Ltd.	4	Reflection and Refraction	Continuous profiling ..	400	203	788	902	79,758	37,295	1,088
		Totals	159			40,605	8,387	..	..	..	..	..
By Government Agencies												
Surveys carried out by the Bureau of Mineral Resources, Geology and Geophysics—												
Surat and Eromanga Basins			4½	(*a*) Reflection—Regional ..	Continuous profiling ..	..	124	343	401	54,941	16,920	..
				(*b*) Refraction—Regional ..	Reverse line profiles (8) ..	..	..	30				
Grand Totals			163½			40,605	8,511					

PART 3—DRILLING

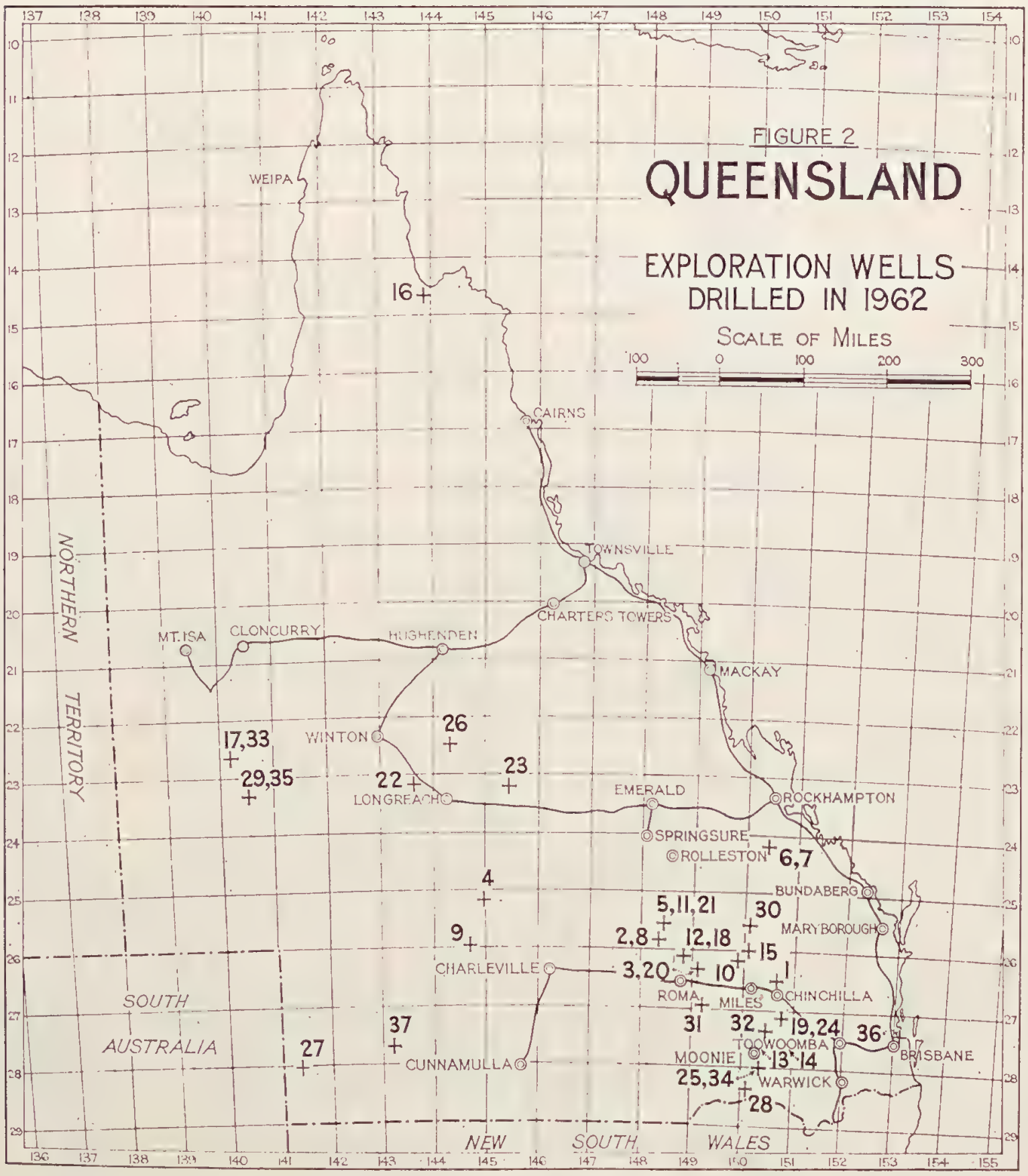
A feature of the year's exploration activity has been the very marked and sustained increase in exploration drilling. The total number of such wells drilled to completion during the year was 30 as compared with 12 for the year 1961. In addition 8 exploration wells were drilling at the end of 1962. These figures do not include scout bores, 2 of which were drilled during the year.

A separate category of wells has been necessitated by the development of Australia's first oilfield at Moonie. Nine development wells were drilled during the year and 1, Moonie No. 11, was drilling at the end of the year.

The increase in drilling is also illustrated by footage figures. In exploration drilling the footage drilled jumped from 74,935 ft. in 1961 to 177,248 ft. in 1962, whilst in addition over 60,000 ft. of development drilling was carried out on the Moonie oilfield.

An interesting feature of the exploration drilling was the number of relatively deep holes drilled, no fewer than 6 wells being over 10,000 ft. in depth. The deepest well drilled was Phillips-Sunray Gumbardo No. 1 which bottomed at 12,940 ft.

Figure 2 shows sites of wells drilled in the State in 1962, also geographical co-ordinates, elevations and depths. Table G comprises a list in chronological order of all wells drilled during the year in their various categories.



INDEX

No.	Well	Latitude (S)	Longitude (E)	Ground Elevation	Height of Rotary Table or Kelly Bushing	Depth at 31–12–62
				Ft.	Ft.	Ft.
	ROTARY DRILLING					
1	C.O.L. No. 1 (Speculation)	26°28′52″	150°39′24″	..	..	2,725
2	A.A.O. Glentulloch No. 1	25°47′17″	148°22′47″	1,507	10	Testing only 4,083
3	A.A.O. Meeleebee No. 1	26°11′00″	149°12′00″	1,030	10	5,074
4	Phillips–Sunray Etonvale No. 1	25°09′40″	144°59′40″	1,083	14	11,368
5	A.A.O. Westgrove No. 1	25°32′00″	148°26′00″	1,706	9	6,442
6	Nortex Jambin No. 1	24°11′00″	150°25′00″	510	4½	540
7	Nortex Jambin No. 2	24°11′30″	150°24′20″	490	4½	843
8	A.A.O. Killoran No. 1	25°54′00″	148°19′00″	1,697	10	2,350
9	Phillips–Sunray Gumbardo No. 1	25°58′52″	144°41′41″	916	14	12,940
10	Union–Kern–A.O.G. Wandoan No. 1	26°10′30″	149°54′00″	958	19	10,736
11	A.A.O. Westgrove No. 2	25°33′00″	148°26′00″	1,744	9	5,550
12	A.A.O. Rosewood No. 1	26°04′00″	148°41′50″	1,400	5	2,075
13	Union–Kern–A.O.G. Middle Creek No. 1	27°38′45″	150°18′35″	901	12	6,126
14	Phillips–Sunray–Queensland American Durabilla No. 1	27°33′00″	150°51′45″	1,257	11	4,358
15	Union–Kern–A.O.G. Burunga No. 1	26°00′00″	150°04′43″	1,074	17½	10,242
16	Cabot–Blueberry Marina No. 1	14°38′10″	143°52′30″	70	10	3,829
17	Phillips–Sunray Black Mountain No. 1	22°32′30″	140°17′00″	850	11	5,511
18	A.A.O. Kooringa No. 1	26°07′10″	148°58′40″	1,163	5	1,823
19	Phillips–Sunray–Queensland American Kogan No. 1	27°05′16″	150°47′55″	1,226	11	3,437
20	A.A.O. Pleasant Hills No. 1	26°25′10″	149°00′10″	1,248	5	3,485
21	A.A.O. Westgrove No. 3	25°34′00″	148°26′00″	1,719	13	12,571
22	A.A.O. Penrith No. 1	23°10′20″	143°38′30″	700	9	4,078
23	Oil Development Maranda No. 1	23°12′14″	145°26′40″	850	12	6,491
24	Phillips–Sunray–Queensland American Kogan South No. 1	27°08′40″	150°48′08″	1,198	11	3,519
25	Union–Kern–A.O.G. Yarrill Creek No. 1	28°04′42″	150°25′16″	908	13	4,545
26	Exoil Brookwood No. 1	22°28′55″	144°19′58″	735	11	4,806
27	Delhi–Santos Orientos No. 1	28°03′20″	141°25′38″	459	15	11,527
28	Union–Kern–A.O.G. Minima No. 1	28°21′33″	150°06′54″	680	11	7,142
29	Phillips–Sunray Canary No. 1	23°15′30″	140°22′30″	515	11	3,218
30	Union–Kern–A.O.G. Cockatoo Creek No. 1	25°34′22″	150°06′15″	656	17½	7,555
31	A.A.O. Sunnybank No. 1	26°56′25″	149°13′30″	823	9	7,124
32	Union–Kern–A.O.G. Tara No. 1	27°20′50″	150°29′26″	1,043	13	6,795
33	Phillips–Sunray Beantree No. 1	22°45′00″	140°05′00″	560	11	2,064
34	Union–Kern–A.O.G. Crowder No. 1	27°52′36″	150°15′34″	855	13	5,081
35	Phillips–Sunray Elizabeth Springs No. 1	23°21′00″	140°36′00″	487	11	297
	PERCUSSION DRILLING					
36	Standard Gas Cribb Island No. 1	27°22′25″	153°07′05″	6	1	2,449½
37	Smart Orient No. 2	27°40′30″	143°11′45″	473	Height of Collar 4 Floor	3,535

Table G

FOOTAGES OF WELLS DRILLED IN 1962—(in chronological order)

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remarks as at end of year
		ROTARY DRILLING (EXPLORATION)			
C.O.L. No. 1 (Speculation)	22 miles north of Chinchilla (P.P.P. 708)	Condamine Oil Ltd.	404	..	Drilling at 2,725
Union – Kern – A.O.G. Moonie No. 1	34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	..	6,106	Completed as a productive well
A.A.O. Glentulloch No. 1	12 miles west of Injune (55P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	..	4,083	Suspended gas well
A.A.O. Meeleebee No. 1	36 miles north-east of Roma (55P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	5,075	5,075	Plugged as a dry hole
Phillips–Sunray Etonvale No. 1	58 miles south-west of Blackall (84P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Delta Drilling Company)	2,826	11,368	Plugged as a dry hole

Table G—continued

FOOTAGES OF WELLS DRILLED IN 1962—(in chronological order)—*continued*

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remarks as at end of year
A.A.O. Westgrove No. 1	18 miles north of Glentulloch (55P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	6,442	6,442	Plugged as a dry hole
Nortex Jambin No. 1	14 miles north-north-west of Biloela	Nortex Australian Oils Ltd. (Price—Anderson)	540	540	Plugged as a dry hole
Nortex Jambin No. 2	1 mile south-west of Jambin No. 1	Nortex Australian Oils Ltd. (Price—Anderson)	843	843	Plugged as a dry hole
A.A.O. Killoran No. 1	16 miles west-south-west of Injune (55P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd., and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	2,350	2,350	Suspended pending conversion to a water well
Phillips-Sunray Gumbardo No. 1	9 miles south-east of Adavale (84P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company (Delta Drilling Company)	12,940	12,940	Plugged as a dry hole
Union – Kern – A.O.G. Wandoan No. 1	6 miles south-west of Wandoan (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	10,736	10,736	Plugged as a dry hole
A.A.O. Westgrove No. 2	23 miles north-north-west of Injune (55P and 56P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	5,550	5,550	Suspended gas well
A.A.O. Rosewood No. 1	16 miles south-east of Injune (55P and 56P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	2,075	2,075	Plugged as a dry hole
Union – Kern – A.O.G. Middle Creek No. 1	8 miles north-east of Moonie (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Mines Administration Pty. Ltd.)	6,126	6,126	Plugged as a dry hole
Phillips–Sunray–Queensland American Durabilla No. 1	20 miles west of Cecil Plains (71P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Delta Drilling Company)	4,358	4,358	Plugged as a dry hole
Union – Kern – A.O.G. Burunga No. 1	12 miles north-east of Wandoan (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	10,242	10,242	Plugged as a dry hole (Gas recorded)
Cabot – Blueberry Marina No. 1	65 miles south-east of Coen (61P)	Cabot Corporation with whom are associated Blueberry Oil Corporation and Curran R. Campbell Incorporated and Associated Australian Oilfields N.L. (Mines Administration Pty. Ltd.)	3,829	3,829	Plugged as a dry hole
Phillips–Sunray Black Mountain No. 1	38 miles north-east of Boulia (54P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Mines Administration Pty. Ltd.)	5,511	5,511	Plugged as a dry hole
A.A.O. Kooringa No. 1	34 miles north-north-east of Roma (55P and 56P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	1,823	1,823	Awaiting completion as a water well
Phillips–Sunray–Queensland American Kogan No. 1	26 miles south-east of Chinchilla (71P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Oil Drilling and Exploration Ltd.)	3,437	3,437	Plugged as a dry hole

Table G—continued

FOOTAGES OF WELLS DRILLED IN 1962—(in chronological order)—*continued*

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remarks as at end of year
A.A.O. Pleasant Hills No. 1	18 miles north-east of Roma (55P and 56P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd., and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	3,485	3,485	Awaiting completion as a water well
A.A.O. Westgrove No. 3	23 miles north-north-west of Injune (55P and 56P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Richter-Bawden Drilling Pty. Ltd.)	12,570	..	Drilling
A.A.O. Penrith No. 1	42 miles west of Longreach (86P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Richter-Bawden Drilling Pty. Ltd.)	4,078	4,078	Plugged as a dry hole
Oil Development Maranda No. 1	20 miles south-east of Aramac (81P)	Oil Development N.L. (Reading and Bates Offshore Drilling Co.)	6,491	..	Drilling
Phillips–Sunray–Queensland American Kogan South No. 1	29 miles south-east of Chinchilla (71P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Oil Drilling and Exploration Ltd.)	3,519	3,519	Plugged as a dry hole
Union – Kern – A.O.G. Yarrill Creek No. 1	25 miles south of Moonie (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	4,545	4,545	Completed as a water well
Exoil Brookwood No. 1	16 miles north-west of Muttaburra (76P)	Exoil N.L. (Richter-Bawden Drilling Pty. Ltd.)	4,806	4,806	Plugged as a dry hole
Delhi–Santos Orientos No. 1	125 miles south-west of Eromanga (66P and 67P)	Delhi Australian Petroleum Ltd. with whom are associated Santos Ltd. (Drilling Contractors (Australia) Pty. Ltd.)	11,527	11,527	Completed as a water well
Union – Kern – A.O.G. Minima No. 1	40 miles south of Moonie (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	7,142	7,142	Plugged as a dry hole
Phillips–Sunray Canary No. 1	38 miles south-east of Boulia (54P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Richter-Bawden Drilling Pty. Ltd.)	3,218	3,218	Plugged as a dry hole
Union – Kern – A.O.G. Cockatoo Creek No. 1	23 miles east of Taroom (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	7,555	..	Drilling
A.A.O. Sunnybank No. 1	18 miles north-east of Surat (55P and 56P)	Associated Australian Oilfields N.L. with whom are associated Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Co. Ltd., Interstate Oil Ltd., H. C. Sleigh Ltd. and Associated Continental Petroleum N.L. (Mines Administration Pty. Ltd.)	7,124	..	Drilling
Union – Kern – A.O.G. Tara No. 1	5 miles south-east of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	6,795	6,795	Plugged as a dry hole
Phillips–Sunray Beantree No. 1	18 miles north-east of Boulia (54P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Richter-Bawden Drilling Ltd.)	2,064	2,064	Plugged as a dry hole
Union – Kern – A.O.G. Crowder No. 1	6 miles south-east of Moonie No. 9 (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	5,081	..	Drilling

Table G—continued

FOOTAGES OF WELLS DRILLED IN 1962—(in chronological order)—*continued*

Name of Well	Location (and Title)	Operator (and Contractor)	Footage Drilled	Completed Depth	Results and Remarks as at end of year
Phillips–Sunray Elizabeth Springs No. 1	55 miles south-east of Boulia (54P)	Phillips Petroleum Company with whom are associated Sunray D.X. Oil Company. (Richter-Bawden Drilling Pty. Ltd.)	297	..	Drilling
		PERCUSSION DRILLING (EXPLORATION)			
Standard Gas Cribb Island No. 1	Cribb Island (P.P.P. 704)	Standard Gas Pty. Ltd. (Australasian Drilling Services)	439	..	Drilling at 2,440 ft.
Smart Orient No. 2 ..	36 miles east of Noccundra (85P)	L. H. Smart Oil Exploration Company Ltd. (Australasian Drilling Services)	1,405	3,535	Plugged as a dry hole
		ROTARY DRILLING (DEVELOPMENT)			
Union – Kern – A.O.G. Moonie No. 2	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	6,289	6,289	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 3	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Mines Administration Pty. Ltd.)	6,021	6,021	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 4	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Mines Administration Pty. Ltd.)	6,005	6,005	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 5	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Richter-Bawden Drilling Pty. Ltd.)	5,990	5,990	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 6	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Oil Drilling and Exploration Ltd.)	6,502	6,502	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 7	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Richter-Bawden Drilling Pty. Ltd.)	5,953	5,953	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 8	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Richter-Bawden Drilling Pty. Ltd.)	6,031	6,031	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 9	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Richter-Bawden Drilling Pty. Ltd.)	5,942	5,942	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 10	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Richter-Bawden Drilling Pty. Ltd.)	5,970	5,970	Completed as a productive well
Union – Kern – A.O.G. Moonie No. 11	Moonie oilfield, 34 miles south-south-west of Tara (57P)	Union Oil Development Corporation with whom are associated Kern County Land Company and Australian Oil and Gas Corporation Ltd. (Richter-Bawden Drilling Pty. Ltd.)	5,347	..	Drilling
		SCOUT BORES (PERCUSSION)			
Standard Gas Boondall Scout No. 1	Boondall (P.P.P. 704)	Standard Gas Pty. Ltd. (S. H. Scells) ..	1,014	1,014	Plugged and abandoned
Standard Gas Cribb Island Scout No. 11	Cribb Island (P.P.P. 704)	Standard Gas Pty. Ltd. (S. H. Scells) ..	220	..	Suspended

Table H

DRILLING SUMMARY

Exploration Drilling

Footage drilled during year	177, 248 ft. (1,844 ft. Percussion, 175,404 ft. rotary)
Number of wells drilling at 31st December, 1962	8
Number of wells drilled and/or completed during the year and results:—	
(*a*) Completed as productive well	1
(*b*) Plugged as a dry hole	22
(*c*) Suspended gas well	2
(*d*) Completed water well	2
(*e*) Awaiting completion as a water well	3
Total	30

Development Drilling

Footage drilled during the year	60,050 ft.
Number of wells drilling at 31st December, 1962	1
Number of wells drilled and completed as productive	9

Scout Bores

Footage drilled during the year	1,234 ft.
Number of bores drilling or suspended at 31st December, 1962	1
Number of bores completed during the year	1
Total number of bores completed or awaiting completion at end of year	2

Totals

Total number of wells drilled and/or completed for year	40
Total number of wells drilling or suspended at 31st December, 1962	10
Total number of wells completed, awaiting completion of drilling at end of year	50
Total footage for the year	238,532 ft.

PART 4—EMPLOYMENT AND ACCIDENTS

Employment in the industry in 1962 has again shown an increase in the number of personnel engaged, the total now standing at 692, or almost exactly 100 more than in 1961. Considering the great increase in work performed, it is surprising that the employment figure is not higher, and it is perhaps correct to assume that greater efficiency is being achieved. Table I sets out the number of persons employed in various categories in the industry, the figures given having been averaged out to represent total employment for the year.

TABLE I

EMPLOYMENT

Field																
Geological and Geophysical Surveys				Exploration Drilling				Others	Development Drilling				Others	Office and Administration			Total
Geologists and Geophysicists		Technicians and Helpers		Supervisors, Petroleum Engineers, Geologists, Toolpushers, and Drillers		Drilling Crews			Supervisors, Petroleum Engineers, Geologists, Toolpushers, and Drillers		Drilling Crews			Operator's Employees			
Employed by		Employed by		Employed by		Employed by			Employed by		Employed by			Geologists and Geophysicists	Drilling	Clerical and Administration	
Operator	Contractor	Operator	Contractor	Operator	Contractor	Operator	Contractor		Operator	Contractor	Operator	Contractor					
14	35	6	287	12	24	4	78	45	2	5	..	20	3	49	8	68	660
Employed by Government Agencies																	
10	..	9	..	..	..	..	..	..	..	..	..	..	..	11	..	2	32
Totals 24	35	15	287	12	24	4	78	45	2	5	..	20	3	60	8	70	692

Accident statistics have been compiled only in respect of drilling operations, and although the greatest increase in activity occurred in drilling operations, the number of accidents actually decreased from 33 to 30. This is a very gratifying result. Again the greatest single category of accidents was in crushing and laceration of fingers and hands, chiefly caused in handling tubulars, and the attention of operators once again is drawn to this frequent cause of injury and lost time.

The year's operations unfortunately were marred by the occurrence of one fatal accident. It should be pointed out, however, that this accident, although occurring on a drilling location, was caused by a bursting truck tyre which was being inflated, an operation not directly connected with drilling. A serious accident also occurred when a derrickman who had unlatched his safety belt to latch the elevators onto a stand of drill collars lying beyond the length of his safety belt anchor rope, lost his footing and fell to the derrick floor. His fall was broken by crew members otherwise the accident would almost certainly have been fatal. Another safety belt provided with a longer rope was available on the board; this accident occurred therefore, through the failure of the employee to use the safety equipment provided for his use.

Table J shows a classification of all lost time accidents in drilling operations in the year.

TABLE J

CLASSIFICATION OF ACCIDENTS

(Lost Time only)

Nature of Injuries	Occupation					Injured Member										Agency of Injury					
	Toolpushers	Drillers	Drilling Crew	Others	Total	Fingers	Hands	Arms	Toes	Feet	Legs	Head	Eyes	Body	Total	Moving Machinery	Using tools	Handling Tubulars	Falling Objects	Other Causes	Total
Sprains, Contusions Abrasions, Cuts and Lacerations	..	1	20	3	24	6	2	..	1	5	5	2	..	3	24	2	..	10	..	12	24
Fractures	..	2	..	2*	4	2	..	..	..	1	..	1*	..	..	4	..	..	2	..	2*	4*
Burns	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Other Injuries	..	..	1	1	2	..	..	..	..	..	..	..	2	..	2	..	..	1	..	1	2
Totals	..	3	21	6	30	8	2	..	1	6	5	3	2	3	30	2	..	13	..	15	30

* Includes one fatality.

Lost time Incurred—	Man days
Toolpushers	0
Drillers	96
Drilling Crew	755
Others	88
Total	939

PART 5—LEGISLATION

Important changes in legislation were enacted with the passing of the Petroleum Acts Amendment Act of 1962 in December. This legislation amended the Principal Act (*"The Petroleum Acts,* 1923 *to* 1958") and provided additional clauses to govern the construction and operation of pipelines. The Principal Act and the 1962 amendments are now cited as *"The Petroleum Acts* 1923 *to* 1962".

The principal effects of the amendments are to facilitate the granting of leases, to govern the shape of leases (they are now required to be bounded in terms of a geographic grid) and to define and modernise working obligations of lessees. The drilling of water wells by holders of titles under the Petroleum Acts has been provided for, and the procedure for the conversion of abandoned oil wells into water wells has been facilitated. The principal effects of the *additional* legislation are to provide for permission to be granted for the construction and operation of oil refineries, and for permission to enter upon lands and make investigations, including surveys, for pipeline construction. Provision is also made for the issue of licenses for the construction and operation of pipelines and for the acquisition of land for pipeline purposes.

PART 6—GENERAL SURVEY OF THE INDUSTRY

Exploration

The year 1962 has proved an historic year in the development of the State, since it has seen the establishment at Moonie of the nation's first oilfield, and commencement of preliminary work in connection with the construction and operation of a pipeline to convey Moonie crude to Brisbane where two oil refineries are planned. In order to make adequate and proper provision for the control of these very important developments, a number of essential amendments and additions were made to the legislation governing the search for and production of petroleum.

Other than at Moonie, no additional deposits of petroleum in commercial quantities were disclosed, but the very significant discovery in the well A.A.O. Sunnybank No. 1 in the central Surat Basin, of a light crude oil in the Pickanjinnie Formation (Triassic), has opened new possibilities for exploration. Unfortunately the productive formation proved tight and only a small quantity of oil was recovered, however the importance of the discovery has led to greater attention being given to this area, and to the search for more favourable reservoir rocks in stratigraphic as well as structural traps. Two wells, A.A.O. Westgrove No. 2 and A.A.O. Westgrove No. 3, have shown potential as gas producers, and a considerable reserve of gas is becoming apparent in wells drilled by Associated Australian Oilfields in the Roma-Injune area.

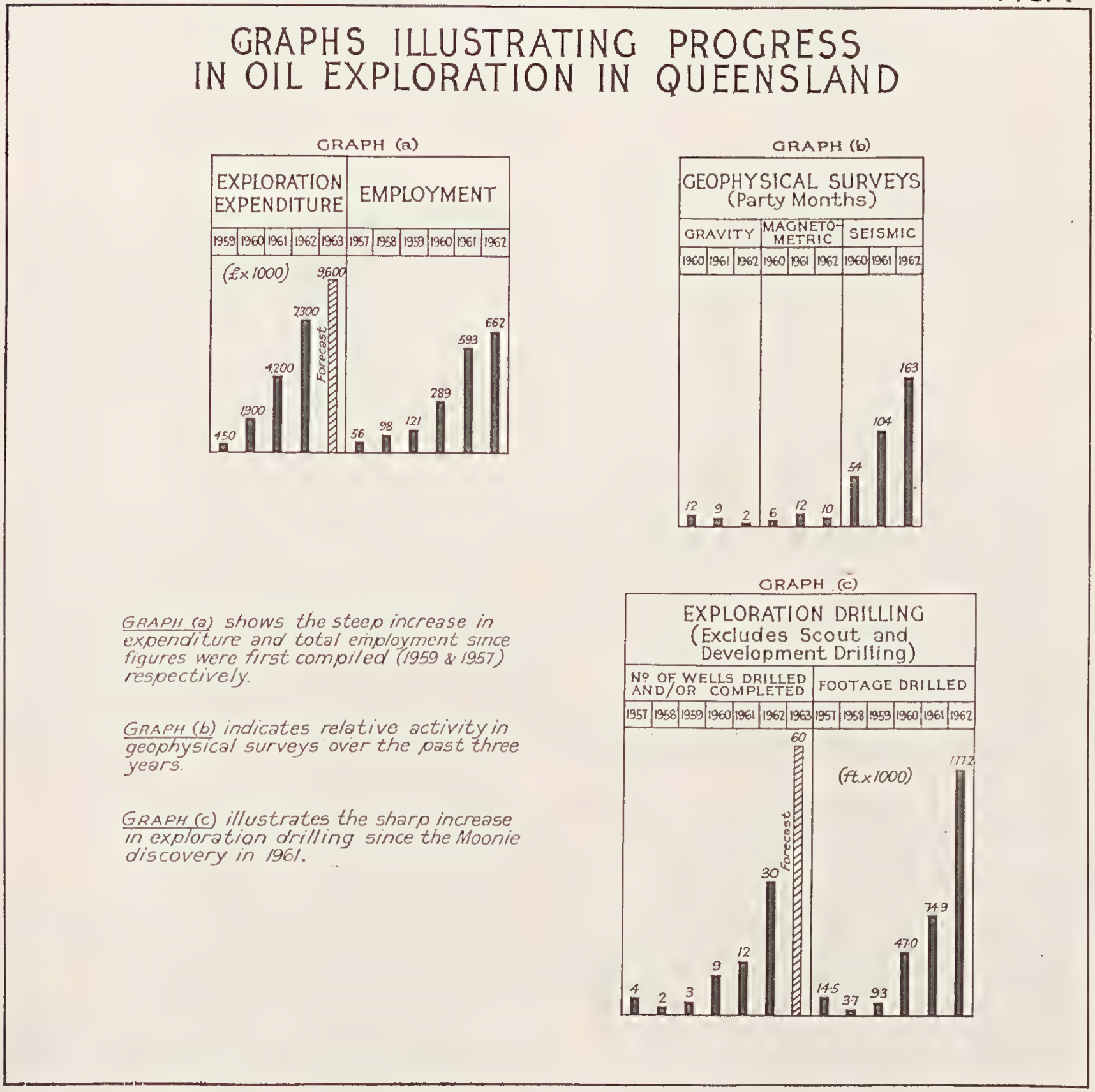
The supply of natural gas to the Roma Town Power Station has continued, and although the demand has increased somewhat, there is no evidence of any inability to meet the demand.

Exploration surveys in general revealed a healthy and sustained increase, both geological and seismic surveys showing a 50 per cent. increase over the previous year. Gravimetric and magnetometric surveys however, have declined in number. A large proportion of the State has now been covered by these surveys, but undoubtedly considerable scope still exists for the use of these excellent reconnaissance tools.

Exploration expenditure for the year at £7,305,000 matched almost exactly the forecast amount of £7,370,000. In 1963 it is expected to reach almost £10 million of which some £9 million will be spent on drilling and seismic surveys. It is to be hoped, and may be expected with confidence, that further discoveries will result from these expenditures.

Figure 4 illustrates graphically the effort which is being made in the search for oil in Queensland, an effort which is being very assiduously and conscientiously carried out by a number of local and overseas companies. It is hoped that their work will be rewarded by further successes.

FIG. 4



Development

None of the statistics quoted above include the work (costing over £800,000) which has proceeded in connection with the development of the Moonie Oilfield. Following completion of Moonie No. 1 (the discovery well) nine wells were drilled in 1962 and closed in as potential producers, and Moonie No. 11 was drilling at the end of the year. The total footage drilled on the Moonie field was 60,050 ft. No sustained production tests have been carried out on these wells, and none is intended until the pipeline and storage tanks have been constructed. Until this has been done, no accurate estimate can be made as to the production to be expected. On drillstem tests, production ranged from some 200 barrels per day (Moonie No. 8) to over 2,000 barrels per day (Moonie No. 2).

It is anticipated that in 1963 over £5½ million will be spent on pipeline construction, production facilities and development drilling, and it is extremely encouraging that a start has been made to reduce the country's dependence on overseas supplies of this vitally essential commodity.

DRILLING RESULTS

By I. G. SANKER, Geologist

This section presents a short history of each of the exploration wells drilled in Queensland for petroleum in 1962. The details of each well were summarized from well completion reports and progress reports submitted to the Department of Mines by the companies concerned. The stratigraphic names are those used by the companies, and are not necessarily in accordance with the Australian Code of Stratigraphic Nomenclature.

A.A.O. Glentulloch No. 1

This well was drilled to 4,083 ft. during 1961. Six drill-stem tests were conducted during the drilling of the well, and testing continued in 1962, after the hole had been plugged back from total depth to 3,016 ft., and 6⅝-in. production casing had been set to 3,006 ft.

The testing in 1962 is summarized below, the tests being listed in chronological order.

Production Test No. 1 (Perforations at at 2,496–2,502 ft., 2,504–2,517 ft., 2,522–2,530 ft.; packer at 2,468 ft.).	Produced gas (300 mcfd.) and slightly saline water (340 bbls./day).
Drill Stem Test No. 7 (Perforations 2,794–2,795 ft.; packer at 2,777 ft.).	Produced dry gas, estimated at 25 mcfd.
Drill Stem Test No. 8 (Perforations at 2,496–2,502 ft., 2,504–2,517 ft., 2,522–2,530 ft.; packer at 2,475 ft.).	Produced gas (770 mcfd.) and water (206 bbls./day).
Production Test No. 2 (Perforations at 2,496–2,502 ft., 2,504–2,517 ft., 2,522–2,530 ft., 2,794–2,795 ft.; packer at 2,468 ft.).	Produced gas (2100 mcfd.) and water (330 bbls./day).
Drill Stem Test No. 9 (Perforations at 2,585–2,589 ft., 2,622–2,628 ft., 2,641–2,648 ft., 2,654–2,662 ft., 2,794–2,795 ft.; packer at 2,567 ft.).	Produced gas (1574 mcfd.) and water (110 bbls./day).
Drill Stem Test No. 10 (Perforations at 2,722–2,728 ft., 2,737–2,743 ft., 2,744–2,750 ft., 2,794–2,795 ft.; packer at 2,689 ft.).	Produced gas (1273 mcfd.) and water (165 bbls./day).
Drill Stem Test No. 11 (Perforations at 2,755–2,780 ft., 2,783–2,792 ft., 2,794–2,795 ft.; packer at 2,752 ft.).	Test abortive; valve clogged.
Drill Stem Test No. 12 (Perforations at 2,755–2,780 ft., 2,783–2,792 ft., 2,794–2,795 ft.; packer at 2,755 ft.).	No gas or water, although tool operated successfully.
Production Test No. 3 (Perforations at 2,496–2,502 ft., 2,504–2,517 ft., 2,522–2,530 ft., 2,585–2,589 ft., 2,622–2,628 ft., 2,654–2,662 ft., 2,722–2,728 ft., 2,737–2,743 ft., 2,755–2,780 ft., 2,783–2,792 ft., 2,794–2,795 ft.; packer at 2,468 ft.).	Produced gas (3,538 mcfd.) and water (flow not gauged).
Drill Stem Test No. 13 (Perforated at 2,755–2,780 ft., 2,783–2,792 ft., 2,794–2,795 ft.; reperforated 2,755–2,794 ft.; packer at 2,753 ft.).	No gas or water, although tool operated successfully.
Drill Stem Test No. 14 (Perforated at 2,755–2,780 ft., 2,783–2,797 ft., 2,794–2,795 ft.; reperforated at 2,755–2,794 ft., 2,765–2,770 ft.; packer at 2,754 ft.).	No gas or water, although tool operated successfully.

After the completion of testing, the well was plugged from 2,394–2,494 ft. and capped. The hole was re-entered on 6th May and a cement bond log run to determine whether the water being produced with the gas was originating below 2,754 ft. and being produced because of a poor cement bond, or was being produced with the gas from all depths. The cement bond log indicated a good bond in the critical zone, and hence that water and gas were being produced together from the formation. The well is therefore not an economic gas producer. The hole was plugged from 2,450–2,850 ft. and capped on 12th May, 1962.

A.A.O. Meeleebee No. 1

This well was drilled on Authority to Prospect 55P and was located at lat. 26°11′ S., long. 149°12′ E., approximately 27 miles north from Wallumbilla. (Wallumbilla is about 25 miles east from Roma). The well was designed as a stratigraphic test, to examine the sedimentary section and the depositional environment of an area structurally distinct from the Roma-Pickanjinnie area, and to assist in the interpretation of seismic work carried out in the area. The drilling contractor was Mines Administration Pty. Ltd., using a National T-32 drilling rig. Ground elevation was 1,030 ft., and rotary table elevation 1,040 ft. Drilling began on 11th January, 1962, and total depth of 5,074½ ft. was reached on 19th February, 1962. The work was subsidised by the Commonwealth Government.

Hole size was 12¼ in. from surface to 310 ft., 8½ in. to 5,072 ft., and 5⅝ in. to 5,074½ ft. Nine and five-eighths-inch 40-lb. casing was set to 283½ ft. and cemented to surface.

Twelve conventional cores were cut, coring 107½ ft., with average recovery of 80 per cent. Twenty-two sidewall cores were taken by Schlumberger between 2,800 ft. and 5,000 ft. Schlumberger ran electric logs between 284–5,078 ft., a sonic log between 284–5,062 ft. and a microlog/micro caliper log between 2,600–2,800 ft., 3,500–3,600 ft. and 4,200–4,340 ft. Deviation surveys and a velocity survey were run. A Rotary gas log was kept between 340–5,074½ ft.

The company reported the stratigraphic succession to be—

0–1,280 ft.	Injune Creek Beds
1,280–2,150 ft.	Hutton-Boxvale Sandstones
2,150–2,553 ft.	Evergreen Shale
2,553–2,758 ft.	Precipice Sandstone
2,758–3,551 ft.	Rewan Formation
3,551–4,247 ft.	Bandanna Formation
4,247–4,428 ft.	Mantuan Downs Productus Bed
4,428–4,914 ft.	Dry Creek Shale
4,914–5,032 ft.	Early Storms Sandstone
5,032–5,074½ ft.	Timbury Hills Formation

Gas bubbling and fluorescence were noted in kerosene shale in core 8 (4,091–4,098 ft.) in the Bandanna Formation. Oil staining, fluorescence and petroliferous odour were noted in core 11 (4,981–4,988 ft.) in the Early Storms Sandstone. Three drill-stem tests were conducted, the results of which are summarized as—

D.S.T. No. 1 (2,540–2,605 ft.)	Recovered drilling mud
D.S.T. No. 2 (2,619–2,705 ft.)	Recovered fresh water
D.S.T. No. 3 (4,930–4,988 ft.)	Recovered drilling mud

Cement plugs were set between 4,800–4,900 ft., 2,900–3,000 ft., 2,400–2,500 ft., 1,100–1,200 ft., 255–305 ft. and surface–20 ft. and the well abandoned as a dry hole on 23rd February, 1962.

A.A.O. Westgrove No. 1

This well was located at lat. 25°32′ S., long. 148°26′ E., about 24 miles north-north-west from Injune. It was drilled 350 ft. down flank on the northern end of the Westgrove Anticline which was delineated seismically, and was designed as a test of that structure. The drilling contractor was Mines Administration Pty. Ltd., and the rig a National T-32. Ground elevation was 1,706 ft., and rotary table elevation was 1,715 ft. Drilling was commenced on 15th February. 1962, and was completed on 9th April at total depth of 6,442 ft., the limit of the rig. Basement was not reached. The work was subsidized by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 280 ft. and 9⅝-in. 40-lb. casing was set to 270 ft. and cemented to the surface. Eight and one-half inch hole was drilled from 280 ft. to total depth.

Fifteen conventional cores were cut between 1,630 ft. and 6,236 ft., coring 138½ ft. with 87 per cent. recovery. Nine side-wall cores were taken between 950 ft. and 1,588 ft. Schlumberger ran electric logs between 268–6,442 ft., a microlog/caliper log between 3,520–3,620 ft. and 4,400–4,803 ft., a sonic log between 267–6,430 ft. and a velocity log between 267–6,430 ft. A gas-detection unit was maintained, and deviation surveys were made.

The company reported the stratigraphic succession to be—

0– 200 ft.	Hutton Sandstone
200– 306 ft.	Evergreen Shale
306– 705 ft.	Precipice Sandstone
705–1,657 ft.	Rewan Formation
1,657–2,254 ft.	Bandanna Formation (Permian, unit 1)
2,254–2,488 ft.	Mantuan Productus Bed (Permian, unit 2)
2,488–2,924 ft.	Dry Creek Shale (Permian, unit 3)
2,924–3,100 ft.	Conglomerate (Permian, unit 4)
3,100–3,270 ft.	Shale (Permian, unit 5)
3,270–3,609 ft.	Sandstone (Permian, unit 6)
3,609–4,126 ft.	Shale (Permian, unit 7)
4,126–6,442 ft.	Coal, Sandstone, Shale (Permian, unit 8)

Methane gas dissolved in water was recovered by D.S.T. No. 1 in the Rewan Formation. Gas bleeding was noted in core from the Permian unit 4. D.S.T. No. 7 recovered gas from the Permian unit 6, and fluorescence and cut were noted in the basal sandstone of this unit. Gas bleeding of core and fluorescence and cut were also noted in sandstones of the Permian unit 8.

Ten drill stem tests were conducted, and the details and results of these are summarized below—

D.S.T. No. 1 (1,345–1,360 ft.)	Recovered gas and gas-cut fresh water
D.S.T. No. 2 (2,070–2,131 ft.)	Recovered mud
D.S.T. No. 3 (2,955–3,168 ft.)	Misrun
D.S.T. No. 4 (2,955–3,168 ft.)	Misrun
D.S.T. No. 5 (2,965–3,168 ft.)	Misrun
D.S.T. No. 6 (3,269–3,317 ft.)	Recovered mud; tight formation
D.S.T. No. 7 (3,546–3,558 ft.)	Recovered gas and gas-cut fresh water
D.S.T. No. 8 (4,116–4,161 ft.)	Recovered gas and gas-cut mud
D.S.T. No. 9 (4,600–4,612 ft.)	Recovered mud; formation impermeable
D.S.T. No. 10 (4,641–4,804 ft.)	Recovered watery mud; formation water bearing and relatively impermeable

The well was plugged between 3,500–3,650 ft., 2,900–3,000 ft., 650–750 ft., 220–320 ft. and 9–29 ft. and abandoned on 14th April, 1962.

A.A.O. Killoran No. 1

This well was located at lat. 25°54′ S., long. 148°19′ E., approximately 16 miles west-south-west from Injune, and was drilled to test the crestal zone of the Killoran seismic structure. The drilling contractor was Mines Administration Pty. Ltd., and the rig a National T-32 drilling rig. Ground elevation was 1,697 ft., and rotary table elevation 1,707 ft. Drilling commenced on 2nd April, 1962, and total depth of 2,350 ft. was reached on 16th April. The work was subsidised by the Commonwealth Government.

Hole size was 12¼ in. from surface to 257 ft., and 8½ in. from 257 ft. to total depth. Nine and five-eighths-in. 40-lb. casing was set to 240 ft. and cemented to surface.

Seven conventional cores were cut, coring 78 ft. with 58 per cent. recovery. Electric logs were run by Mines Administration Pty. Ltd. using a Failing Logmaster unit between 240–2,060 ft., and by Schlumberger between 240–2,345 ft. Schlumberger also ran micrologs and microcaliper logs between 500–900 ft. and between 1,700–2,345 ft. Deviation surveys were run, and a Rotary gas-detection unit was maintained between 150–2,340 ft.

The company reported the stratigraphic succession to be—

0– 590 ft.	Injune Creek Beds
590–1,372 ft.	Hutton Sandstone
1,372–1,570 ft.	Boxvale Sandstone
1,570–1,760 ft.	Evergreen Shale
1,760–1,900 ft.	Precipice Sandstone
1,900–2,031 ft.	Dry Creek Shale
2,031–2,305 ft.	Early Storms Sandstone
2,305–2,350 ft.	Timbury Hills Formation

Fluorescence was noted in the Hutton, Precipice and Early Storms Sandstones. Three drill-stem tests were conducted to test these zones. The results of the testing are summarized below—

D.S.T. No. 1 (555– 618 ft.)	No production; sand tight
D.S.T. No. 2 (1,777–1,842 ft.)	Fresh water produced
D.S.T. No. 3 (2,242–2,350 ft.)	Fresh water containing minor amounts of gas in solution produced

Cement plugs were set between 1,900–2,000 ft. and 1,600–1,700 ft. and the well abandoned on 16th April, 1962, to be converted to a water well. It was later plugged from surface to 70 ft. and finally abandoned on 24th July, 1963.

A.A.O. Westgrove No. 2

This well was located at lat. 25°33′ S., long. 148°26′ E., about 22 miles north-north-west from Injune, and about 2 miles south-south-west from A.A.O. Westgrove No. 1. It was sited on the crest of the seismically-determined Westgrove Anticline and was designed to test various sands encountered in A.A.O. Westgrove No. 1, in a crestal position. The drilling contractor was Mines Administration Pty. Ltd., and the drilling rig a National T-32. Rotary table elevation was 1,753 ft., and ground elevation 1,744 ft. Drilling commenced on 29th April, 1962 and total depth of 5,550 ft. was reached on 4th June, 1962. The work was subsidised by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 300 ft., and 8½ in. hole from 300 ft. to 5,550 ft. Nine and five-eighths-inch 40-lb. casing was set to 290 ft. and cemented to surface. Six and five-eighths 28-lb. and 20-lb. casing was set to 3,204 ft. and cemented to 2,346 ft.

Eight conventional cores were cut, coring 98 ft. with 73 per cent. recovery. Schlumberger recovered 13 side-wall cores between 2,290 ft. and 3,880 ft. Schlumberger ran electric logs between 290 ft. and 5,555 ft., micrologs between 2,600–3,112 ft., 4,100–4,340 ft. and 4,200–4,700 ft., section gauge between 290 ft. and 3,600 ft., gamma ray log between 100 ft. and 3,202 ft. and cement bond logs between 2,000–3,200 ft. and 2,100–2,890 ft. Mines Administration Pty. Ltd. ran an

electric log between 290 ft. and 3,675 ft. A Rotary gas log was run between 300 ft. and 5,550 ft., and deviation surveys were conducted.

The company reported the stratigraphic succession to be—

0– 60 ft.	Hutton Sandstone
60– 350 ft.	Evergreen Shale
350– 735 ft.	Precipice Sandstone
735–1,370 ft.	Rewan Formation
1,370–1,971 ft.	Bandanna Formation (Unit 1)
1,971–2,138 ft.	Mantuan Productus Bed (Unit 2)
2,138–2,584 ft.	Dry Creek Shale (Unit 3)
2,584–2,662 ft.	Early Storms Sandstone (Unit 4)
2,662–2,786 ft.	Unit 5
2,786–3,121 ft.	Unit 6
3,121–3,643 ft.	Unit 7
3,643–4,790 ft.	Unit 8
4,790–5,550 + ft.	Unit 9

Unit 8 in A.A.O. Westgrove No. 1 has become more arenaceous in A.A.O. Westgrove No. 2, and the unit is divided into two parts in this well. The upper part (unit 8 in this well) is a coal measure sequence, and the lower part (unit 9) is a sandstone and siltstone sequence with minor coal bands.

The main target section in the well was unit 6 and the porous and permeable sandstones of this section showed good fluorescence and gas shows. Thin sandy members of units 8 and 9 showed good fluorescence and minor gas. Thirteen drill-stem tests and three production tests were conducted.

Nine drill-stem tests (Nos. 1–9) were run in the open hole during drilling of the well. Four drill-stem tests (Nos. 10–13) were run through perforations after the hole had been cased. The three production tests were run through perforations in the casing. The details and results of these tests are summarized below—

D.S.T. No. 1	(3,067–3,110 ft.)	Recovered salt water and minor gas
D.S.T. No. 2	(2,868–3,110 ft.)	Recovered salt water and minor gas
D.S.T. No. 3	(2,859–2,990 ft.)	Produced dry gas (1313 mcfd.)
D.S.T. No. 4	(3,207–3,267 ft.)	Recovered salt water and minor gas
D.S.T. No. 5	(4,036–4,136 ft.)	Recovered minor gas
D.S.T. No. 6	(4,760–4,820 ft.)	Misrun
D.S.T. No. 7	(4,758½–4,820 ft.)	Misrun
D.S.T. No. 8	(4,757–4,820 ft.)	Produced dry gas; flow died quickly
D.S.T. No. 9	(5,480–5,550 ft.)	Recovered minor gas
D.S.T. No. 10	(perf. 2,970 ft.; packer at 2,960 ft.)	Produced gas (204 mcfd.) and salt water
D.S.T. No. 11	(perf. 2,960 ft.; packer at 2,954 ft.)	Produced minor gas and water
D.S.T. No. 12	(perf. 2,886 ft.; packer at 2,809 ft.)	No flow
D.S.T. No. 13	(perf. 2,790 ft.; packer at 2,779 ft.)	Produced gas (390 mcfd.)
P.T. No. 1	(perf. 2,807–2,815 ft., 2,821–2,825 ft., 2,834–2,840 ft.; packer at 2,772 ft.)	Produced dry gas (2442 mcfd.)
P.T. No. 2	(perf. 2,919–2,929 ft.; packer at 2,891 ft.)	Abandoned due to communication between the two sets of perforations
P.T. No. 3	(perf. 2,807–2,815 ft., 2,821–2,825 ft., 2,834–2,840 ft., 2,919–2,929 ft.; packer at 2,773 ft.)	Produced dry gas (3539 mcfd.)

Cement plugs were set between 4,070–4,700 ft., 3,214–3,600 ft. and 2,620–2,950 ft., and the well capped as a suspended gas well having open flow potential of 4·75 mmcfd. on 25th June, 1962.

A.A.O. Rosewood No. 1

This well was located at lat. 26°04′00″ S., long. 148°41′50″ E., 36 miles north-north-west from Roma. The drilling was designed to test the seismically-delineated Rosewood Structure for hydrocarbon accumulations. The drilling contractor was Mines Administration Pty. Ltd., using a Sullivan 300A drilling rig. Ground elevation was 1,400 ft., and rotary table elevation 1,405 ft. The well was spudded on 17th May, 1962, and total depth of 2,075 ft. was reached on 31st May, 1962. The work was subsidized by the Commonwealth Government.

Hole size was 10⅝ in. from surface to 205 ft., 7⅞ in. to 413 ft. and 5⅝ in. to total depth. Eight and five-eighths-inch 28-lb. casing was set to 201 ft. and cemented to surface.

Two conventional cores were cut, from 1,790–1,808 ft. and 2,070–2,075 ft., with 100 per cent. recovery. Electric logs were run by Schlumberger from 202–2,067 ft., and by Mines Administration Pty. Ltd. using a Failing Logmaster unit from 200–1,015 ft. Deviation surveys were run, and a Rotary gas log was kept between 344–2,075 ft.

The company reported the stratigraphic succession to be:—

0– 512 ft.	Injune Creek Beds
512–1,343 ft.	Hutton-Boxvale Sandstone
1,343–1,785 ft.	Evergreen Shale
1,785–1,900 ft.	Precipice Sandstone
1,900–2,062 ft.	Moolayember Formation
2,062–2,075 ft.	Granite

Fluorescence was noted in the Hutton Sandstone at 1,000 ft. Fluorescence and droplets of free oil were noted in the Precipice Sandstone between 1,785–1,795 ft. Three drill stem tests were conducted, the results of which are summarized below—

D.S.T. No. 1	(988–1,017 ft.)	Water produced
D.S.T. No. 2	(1,761–1,790 ft.)	Water produced
D.S.T. No. 3	(2,027–2,056 ft.)	Water produced

Cement plugs were set between 2,025–2,075 ft., 1,700–1,750 ft., 200–250 ft. and surface–25 ft., and the well abandoned as a dry hole on 2nd June, 1962.

A.A.O. Kooringa No. 1

This well was located at lat. 26°07′10″ S., long. 148°58′40″ E., 34 miles north-north-east from Roma, and approximately midway between A.A.O. Rosewood No. 1 and A.A.O. Meeleebee No. 1 It was drilled as a test of the Kooringa seismic structure. The drilling contractor was Mines Administration Pty. Ltd., and the drilling rig a Sullivan 300A. Rotary table elevation was 1,168 ft., and ground elevation 1,163 ft. Drilling commenced on 27th July, 1962, and reached total depth of 1,823 ft. on 9th August, 1962. The work was subsidized by the Commonwealth Government.

Ten and five-eighths-inch hole was drilled from surface to 205 ft., 7⅞ in. hole from 205 ft. to 340 ft., and 5⅝ in. hole from 340 ft. to total depth. Eight and five-eighths-inch 28-lb. casing was set to 200 ft. and cemented to surface.

Five conventional cores were cut between 814 ft. and total depth, coring 48 ft. with 88 per cent. recovery. Schlumberger ran an electric log between 200 ft. and 1,822 ft., and a gamma ray log between 100 ft. and 1,815 ft. A Rotary gas log was kept between 240 ft. and 1,823 ft. Deviation surveys were run.

The company reported the stratigraphic succession to be:—

0– 482 ft.	Injune Creek Beds
482–1,144 ft.	Hutton Sandstone
1,144–1,552 ft.	Evergreen Shale
1,552–1,653 ft.	Precipice Sandstone
1,653–1,760 ft.	? Bandanna Formation
1,760–1,823 ft.	Timbury Hills Formation

Rare pale-blue and blue-white fluorescence were noted in the upper part of the Hutton Sandstone and towards the base of the Evergreen Shale. Strong blue-white fluorescence was recorded in the Precipice Sandstone. Two drill-stem tests were conducted to test this formation. The results of these tests are summarized as—

D.S.T. 1 (1,566–1,594 ft.) Test abortive; packer seat failed

D.S.T. 2 (1,582–1,594 ft.) Recovered fresh water

Cement plugs were set between 1,482 ft. and 1,538 ft. and 517 ft. and 557 ft. and the well abandoned on 11th August, 1962, to be converted to a water well. It was later plugged from surface to 15 ft. and finally abandoned on 23rd July, 1963.

A.A.O. Pleasant Hills No. 1

This well was located at lat. 26°25′10″ S., long. 149°00′10″ E., 18 miles north-east from Roma. It was drilled on the crest of the seismically-determined Pleasant Hills Structure, and was designed to test the petroleum potential of that structure. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a Sullivan 300A. Rotary table elevation was 1,253 ft., and ground elevation 1,248 ft. Drilling commenced on 20th August, 1962, and was completed at total depth 3,485 ft. on 8th September, 1962. The work was subsidized by the Commonwealth Government.

Ten and five-eighths-inch hole was drilled from surface to 255 ft., and 8⅝-in. 28-lb. casing was set to 250 ft. and cemented to surface. Seven and seven-eighths-inch hole was drilled from 255 ft. to 480 ft. and 5⅝ in. hole from 480 ft. to total depth.

One conventional core only was cut, in the basement section, coring and recovering 9 ft. Schlumberger ran an electric log between 250 ft. and 3,484 ft. Deviation surveys were run, a drilling-rate log kept and a Rotary continuous gas-detection unit maintained.

The company reported the stratigraphic succession to be:—

Surface– 678 ft	Blythesdale Formation
678–1,987 ft.	Injune Creek Beds
1,987–2,856 ft.	Hutton—Boxvale Sandstone
2,856–3,310 ft.	Evergreen Shale
3,310–3,385 ft.	Precipice Sandstone
3,385–3,485 ft.	Granite

Methane gas encountered between 900 ft. and 1,000 ft. was the only indication of hydrocarbons reported from the well. Five drill-stem tests were conducted, the results being summarized as:—

D.S.T. No. 1 (955–1,017 ft.)	Recovered drilling mud; interval impermeable
D.S.T. No. 2 (3,306–3,485 ft.)	Test failed; packer did not seat
D.S.T. No. 3 (3,314–3,485 ft.)	Test failed; packer did not seat
D.S.T. No. 4 (3,292–3,485 ft.)	Test failed; packer did not seat
D.S.T. No. 5 (3,335–3,485 ft.)	Test failed; packer did not seat

Cement plugs were set between 3,150–3,300 ft., 2,800–2,950 ft., 1,900–2,050 ft. and 700–850 ft., and the well abandoned on 10th September, 1962. The upper part of the hole was converted to a water well producing from the Blythesdale Formation.

A.A.O. Westgrove No. 3

This well was located at lat. 25°34′S., long. 148° 26′E., 20 miles north-west from Injune. It was drilled 3 miles south-south-west of A.A.O. Westgrove No. 1 and 1 mile south of A.A.O. Westgrove No. 2. A.A.O. Westgrove No. 3 was sited on the crest of the seismically-delineated Westgrove Anticline and the drilling was designed as a further test of that structure.

The drilling contractor was Richter Bawden Drilling Pty. Ltd., and the drilling rig an Oilwell 76. Drilling commenced on 24th August, 1962, and was completed on 6th January, 1963, at a total depth of 12,663 ft. Rotary table elevation was 1,732 ft. and ground elevation was 1,719 ft. Drilling below 2,900 ft. was subsidized by the Commonwealth Government.

Seventeen and one-half inch hole was drilled from surface to 285 ft., after which 13⅜ in. 48 lb. casing was set to 278 ft. and cemented to surface. Twelve and one-quarter inch hole was drilled from 285 ft. to 3,000 ft. and 9⅝ in. 40 lb. casing was set to 2,985 ft. and cemented to 2,000 ft. Eight and one-half inch hole was drilled from 3,000 ft. to total depth.

Twenty-seven conventional cores were cut, coring, in all, 260½ ft. Twenty-five cores, totalling 211 ft., were recovered, a recovery of 81 per cent.

Schlumberger ran the following logs:—

Electric Logs ..	279–12,369 ft.	
Microlog/Caliper	2,503– 3,370 ft.;	11,900–12,366 ft.
Gamma Ray Logs	2,000– 2,985 ft.; 11,800–12,438 ft.	5,500–12,650 ft.;
Sonic Logs ..	5,500–12,650 ft.;	11,800–12,415 ft.
Cement Bond Log	1,800– 2,985 ft.	
Casing Collar Locator ..	0– 2,850 ft.	
Continuous Dip-meter ..	2,985– 9,062 ft.	

Deviation surveys were run, the maximum deviation recorded being 11° at 10,075 ft. A drilling-time log was kept. Core Laboratories kept gas logs, a continuous hot-wire detector between 300 ft. and total depth, and a "Programmed Hydrocarbon Detector" between 3,500 ft. and total depth. Core Laboratories also provided wellsite services.

The company reported the stratigraphic section penetrated to be:

0– 240 ft.	Hutton-Boxvale Sandstone
240– 423 ft.	Evergreen Shale
423– 762 ft.	Precipice Sandstone
762– 1,393 ft.	Rewan Formation
1,393– 1,950 ft.	Bandanna Formation (Unit 1)
1,950– 2,153 ft.	Mantuan Productus Bed (Unit 2)
2,153– 2,553 ft.	"Dry Creek Shale" (Unit 3)
2,553– 2,620 ft.	"Early Storms Sandstone" (Unit 4)
2,620– 2,756 ft.	Permian (Unit 5)
2,756– 3,052 ft.	Permian (Unit 6)
3,052– 3,576 ft.	Permian (Unit 7)
3,576–12,663 ft.	Permian (Unit 8)
12,663– ? ft.	Basement (quartzite?)

Three sandstone members of Unit 6, 2,756–2,792 ft., 2,855–2,920 ft. and 3,002–3,052 ft., were the primary targets in the well. These three members and sandstone of Unit 7 showed blue-white fluorescence, strong carbon tetrachloride cut and relatively high residual oil saturation in cores. However, no oil was produced in drill-stem tests. Sandstones of Unit 8 showed yellow and orange fluorescence without cut throughout, and blue-white fluorescence with cut in the upper parts. High pressure dry gas associated with coal

seams was recorded between 11,900–12,200 ft. and 12,300–12,350 ft. Eight drill-stem tests were conducted, the results being summarized below:—

D.S.T. No. 1	(2,748– 2,802 ft.)	Produced dry gas (541 mcfd.)
D.S.T. No. 2	(2,855– 2,911 ft.)	Produced dry gas (852 mcfd.)
D.S.T. No. 3	(3,001– 3,028 ft.)	Produced salt water
D.S.T. No. 4	(4,092– 4,160 ft.)	Salt water recovered from tool after fishing
D.S.T. No. 5	(8,269– 8,354 ft.)	No flow
D.S.T. No. 6	(12,303–12,360 ft.)	Produced dry gas (293 mcfd.)
D.S.T. No. 7	(12,270–12,450 ft.)	Packer seat failed
D.S.T. No. 8	(12,303–12,450 ft.)	Packer seat failed

Cement plugs were set between 11,955–12,450 ft., 4,200–4,450 ft., 3,700–3,900 ft., and 2,900–3,400 ft. The well was suspended as a gas well on 12th January, 1963, and is awaiting production testing.

A.A.O. Penrith No. 1

This well was located at lat. 23°10′20″ S., long. 143°38′30″ E., about 42 miles north-west from Longreach. The drilling was designed as a test of the Penrith Anticline, a closed and faulted structure outlined by reflection seismic methods. The well was situated on the crest of the structure. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a National T-32. Rotary table elevation was 709 ft., and ground elevation 700 ft. Drilling commenced on 30th August, 1962, and reached a total depth of 4,078 ft. on 25th September, 1962. The work was subsidized by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 412 ft., and 9⅝-in. 40-lb. casing was set to 403 ft. and cemented to surface. Eight and one-half-inch hole was drilled from 412 ft. to total depth.

Twelve conventional cores were cut, between 510 ft. and 4,018 ft., coring 118 ft. and recovering 81 ft. 7 in. (or 69 per cent.). Schlumberger ran an electric log between 404–4077 ft., a microlog/microcaliper log between 2,550–3,950 ft., a gamma ray log between 112–4,072 ft. and a sonic log between 404–3,651 ft. Mines Administration Pty. Ltd. ran a Failing correlation log between 403–2,750 ft. Deviation surveys were run, a drilling-rate log kept and a Rotary gas-detection unit maintained.

The company reported the stratigraphic succession as—

Surface–1,000 ft.	Winton Formation
1,000–1,835 ft.	Tambo Formation
1,835–1,946 ft.	Toolebuc Member equivalent
1,946–2,578 ft.	Roma Formation
2,578–3,064 ft.	Blythesdale Formation
3,064–3,787 ft.	Walloon Coal Measures
3,787–4,078 ft.	Recrystallized siltstone (basement)

No significant indications of hydrocarbons were reported. Yellow fluorescence with cut was noted in the Blythesdale Formation, and a high gas reading on the gas-detection unit in the Toolebuc Member equivalent. Three drill-stem tests were conducted, the results being summarized below—

D.S.T. No. 1. (3,555-3,886 ft.)	Packer failed to seat.
D.S.T. No. 2. (3,525-3,886 ft.)	Packer failed to seat.
D.S.T. No. 3. (3,479-4,078 ft.)	Recovered mud-cut water.

The well was plugged by setting cement plugs between 3,250–3,400 ft., 2,950–3,100 ft., 2,450–2,600 ft. and 360–412 ft., and abandoned on 30th September, 1962.

A.A.O. Sunnybank No. 1

This well was located at lat. 26°56′25″ S., long. 149°13′30″ E., about 45 miles south-east from Roma and 8 miles south-east from A.A.O. Combarngo No. 1. The drilling was designed to test the possibility of stratigraphic traps in an area indicated by seismic survey to be a zone of wedging out to the west of Lower Triassic and Permian sediments against the shallowing basement. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a National T-32. Rotary table elevation was 832 ft., and ground elevation 823 ft. Drilling commenced on 15th November, and was completed at total depth of 7,134 ft. on 1st January, 1963. The operation was subsidized by the Commonwealth Government.

Seventeen and one-half-inch hole was drilled from surface to 410 ft., and 13⅜-in. 48-lb. casing was set to 401 ft. and cemented to surface. Eight and one-half-inch hole was drilled from 410 ft. to 5,704 ft., and 7⅝-in. hole from 5,704 ft. to 7,134 ft.

Seven conventional cores were cut between 5,820 ft. and 7,134 ft., coring a total of 55½ ft. Six cores of total length 33 ft. 9 in. were recovered, representing a 62 per cent. recovery. Twenty-four sidewall cores were recovered between 4,839 ft. and 5,905 ft. The following logs were run by Schlumberger:—

Electric Log	400–7,130 ft.
Microlog	5,000–7,050 ft.
Caliper	400–7,128 ft.
Gamma Ray Log	50–7,129 ft.
Sonic Log	400–7,120 ft.
Laterolog	5,000–7,000 ft.
Continuous Dipmeter	401–7,127 ft.

Deviation surveys and a velocity survey were run. A drilling-rate log was kept, and a Rotary continuous gas log made from 410 ft. to 7,134 ft.

The company reported the stratigraphic succession as—

Surface–1,210 ft.	Roma Formation
1,210–2,593 ft.	Blythesdale Formation
	1,210–1,405 ft. Transition Member
	1,405–1,650 ft. Mooga Sandstone
	1,650–2,187 ft. Fossilwood Member
	2,187–2,593 ft. Gubberamunda Sandstone
2,593–4,163 ft.	Injune Creek Beds
4,163–4,817 ft.	Hutton Sandstone
4,817–4,958 ft.	Subunit 1 (siltstone and shale, Jurassic)
4,958–4,980 ft.	Subunit 2 (sandstone with interbedded siltstone and shale)
4,980–5,138 ft.	Subunit 3 (siltstone and shale with minor sandstone, Jurassic)
5,138–5,166 ft.	Subunit 4 (sandstone with minor siltstone and shale)
5,166–5,326 ft.	Subunit 5 (siltstone and shale, Triassic)
5,326–5,425 ft.	Subunit 6 (siltstone and shale, some sandstone, Triassic)
5,425–5,510 ft.	Subunit 7 (sandstone)
5,510–5,654 ft.	Subunit 8 (sandstone, siltstone and shale, Triassic)
5,654–5,718 ft.	Subunit 9 (shale, Triassic)

The age determinations of these subunits were made on palynological evidence.

5,718–5,747 ft.	Showground Sandstone
5,747–6,202 ft.	Pickanjinnie Formation
6,202–6,682 ft.	Bandanna Formation
6,682–6,740 ft.	Mantuan Productus Bed
6,740–6,953 ft.	"Dry Creek Shale"
6,953–7,030 ft.	"Early Storms Sandstone"
7,030–7,134 ft.	Granite

A trace of gas was produced from Subunit 4, oil and gas were produced from two sections in the Pickanjinnie

Formation and gas was produced from the Bandanna Formation and the "Early Storms Sandstone". Nine drill-stem tests were conducted during drilling, the results being summarized below—

D.S.T. No. 1. (5,723-5,820 ft.)	Recovered fresh water
D.S.T. No. 2. (5,860-5,925 ft.)	Recovered 50 bbl oil (44·8° API) and 330 mcfd. gas.
D.S.T. No. 3. (5,852-5,925 ft.)	Oil flow (600 bbld.) and gas flow (330 mcfd.)
D.S.T. No. 4. (5,962-6,062 ft.)	Recovered drilling mud; tight formation
D.S.T. No. 5. (6,139-6,175 ft.)	Produced gas, oil and water
D.S.T. No. 6. (6,329-6,395 ft.)	Recovered drilling mud; tight formation
D.S.T. No. 7. 6,432–6,468 ft.	Test failed
D.S.T. No. 8. (6,432-6,468 ft.)	Gas flow (267,500 cfd.)
D.S.T. No. 9. (6,987-7,020 ft.)	Gas flow too small to measure)

Testing of the well is continuing.

Cabot–Blueberry Marina No. 1

This well was located at lat. 14°38'10" S., long. 143°52'30" E., about 70 miles north-north-west from Laura, in the Princess Charlotte Bay area. The drilling was designed as a stratigraphic test of the Laura Basin and was the first such test made in the area. The well was not associated with any known structure favourable to the accumulation of petroleum, but was sited on a low topographic anomaly which coincided with a small positive gravity anomaly. The drilling contractor was Mines Administration Pty. Ltd., and the drilling rig was a National T–32. Ground elevation was 70 ft., and rotary table elevation 80 ft. Drilling commenced on 6th July, 1962, and reached total depth of 3,829 ft. on 28th July, 1962. The work was subsidized by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 495 ft., and 8¼-in. hole from 495 ft. to total depth. Nine and five-eighths-inch 40-lb. casing was set to 489 ft. and cemented to surface.

Fifteen conventional cores were taken, coring 155¼ ft. with recovery of 122 ft. (or 78 per cent.). Mines Administration Pty. Ltd. ran an electric log between 489 ft. and 3,812 ft. with a Failing Logmaster unit. A Rotary gas log was kept from surface to total depth.

The stratigraphic subdivision was based mainly on the electric log and was reported to be—

Surface–220 ft.	Unit A (? Fairview Gravel–? Tertiary)
220–1,142 ft.	Unit B (?Wilgunya Formation–Cretaceous)
1,142–3,566 ft.	Unit C (age equivalents of the Blythesdale Sandstone, Walloon Coal Measures and Hutton Sandstone—Jurassic-Cretaceous)
3,566–3,786 ft.	Unit D (Permian)
3,786–3,829 ft.	Unit E

Unit A consists mainly of coarse sandstone grading in places to pebble conglomerate. Unit B consists of shale with some siltstone and sandstone. Unit C consists dominantly of sandstone with some siltstone and shale and rare coal. Unit D consists mainly of shale with some sandstone and tuff. Unit E consists of sheared basalt.

No significant petroleum manifestations were encountered. Indications were confined to traces of yellow, blue and blue-white fluorescence and cut in Unit C and traces of yellow fluorescence and cut in Unit D. Methane gas was recovered from Units C and D by drill-stem tests.

Four drill-stem tests were conducted. The results are summarized as—

D.S.T. No. 1 (3,554–3,829 ft.)	Nil (packer failed to seat)
D.S.T. No. 2 (3,524–3,829 ft.)	Recovered mud and gas-cut water
D.S.T. No. 3 (3,197–3,829 ft.)	Recovered mud and gas-cut water
D.S.T. No. 4 (2,100–2,371 ft.)	Recovered mud and water

Cement plugs were set between 3,250–3,350 ft., 2,800–2,904 ft., 2,371–2,455 ft., 1,896–2,000 ft., 1,140–1,200 ft., 460–536 ft. and 0–35 ft. and the well abandoned on 7th August, 1962.

Condamine Oil Ltd. No. 1 (Speculation)

Overhaul of equipment and reconditioning of the hole continued during the early part of the year. Drilling recommenced about 22nd June, and the well was deepened from 2,321 ft. to 2,725 ft. by 31st December. Conglomerate was drilled over this interval.

Drilling is continuing.

Delhi-Santos Dullingari No. 1 (South Australia)

This well was located at lat. 28°07'55·6"S., long. 140°52'30"E., in the north-east corner of South Australia, a few miles west of the Queensland border. It was situated about 50 miles south from Delhi-Frome-Santos Innamincka No. 1, and was sited on the crest of the seismically-determined Dullingari closed anticline. This structure was selected as it contained the Permian and pre-Permian sediments existing as a flank wedge on the southern flank of the Innamincka uplift. The drilling contractor was Drilling Contractors (Australia) Pty. Ltd., and the drilling rig a National 80B. The well was spudded on 26th March, 1962, and drilling was completed at total depth of 11,588 ft. on 21st September, 1962. Kelly bushing elevation was 320·4 ft. and ground elevation 304·5 ft. The operation was subsidized by the Commonwealth Government.

Twenty-six inch hole was drilled from surface to 98 ft. and 20 in. 94 lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half inch hole was drilled from 98 ft. to 1,201 ft., and 13⅜ in. 48 lb. casing was set to 1,188 ft. and cemented to surface. Twelve and one-quarter inch hole was drilled from 1,201 ft. to 5,206 ft. and 9⅝ in. 36 lb. casing was set to 5,206 ft., and cemented to 2,424 ft. Eight and one-half inch hole was drilled from 5,206 ft. to total depth. The hole was side tracked between 5,382 ft. and 6,174 ft. Thirty-one cores were cut, fifteen conventional cores and sixteen diamond cores. Total distance cored was 281·5 ft.., and recovery was 232·5 ft. or 83 per cent. The following Schlumberger logs were run:—

Electric	1,184–11,562 ft.
Induction-Electric	97– 1,199 ft., 5,206–9,608 ft.
Sonic	100–11,530 ft.
Microlog-Caliper	5,206–10,537 ft.
Gamma ray-neutron	150–11,555 ft.
Continuous Dipmeter	6,700–11,550 ft.
Temperature survey	5,000– 9,624 ft.

A drilling-time log was kept, and a continuous gas-detection unit maintained. Deviation surveys were run, the maximum deviation being 32° from vertical at 11,100 ft. A velocity survey was run at total depth.

The company reported the stratigraphic succession as—

Surface–160 ft.	Quaternary
160– 448 ft.	Tertiary
448–2,549 ft.	Winton Formation
2,549–3,538 ft.	Tambo Formation
3,538–4,492 ft.	Roma Formation
4,492–4,774 ft.	Transition Beds
4,774–5,792 ft.	Mooga Sandstone
5,792–6,182 ft.	Walloon Formation
6,182–6,707 ft.	Lower Triassic
6,707–9,050 ft.	Permian
6,707–7,296 ft.	Upper Sandstone Unit
7,296–7,524 ft.	Upper Shale Unit
7,524–7,718 ft.	Middle Sandstone Unit
7,718–7,926 ft.	Lower Shale Unit
7,926–8,930 ft.	Lower Sandstone Unit
8,930–9,050 ft.	Basal Boulder Clay Unit
9,050–11,588 ft.	Ordovician

The Ordovician section is unconformable beneath the Permian. It consists dominantly of shale, is subdivided into four units and ranges from Lower Ordovician to Middle to Early Upper Ordovician on fossil (graptolite) evidence.

Methane gas was recorded from the Mooga Sandstone, and traces of oil were noted in Permian sandstones. Three drill stem tests were run to evaluate the indications in the Permian. The results of the testing are summarized as—

D.S.T. No. 1 (7,935–7,976 ft.) Test failure
D.S.T. No. 2 (7,933–7,976 ft.) Recovered water
D.S.T. No. 3 (8,280–8,327 ft.) Recovered water

The well was plugged between 5,700–6,000 ft. and completed as a water well, producing from the Blythesdale Formation, on 29th September, 1962.

Delhi-Santos Orientos No. 1

This well was located at lat. 28°03′20″ S., long. 141° 25′38″ E., in south-west Queensland, approximately 35 miles east of Delhi-Santos Dullingari No. 1. It was sited on the crest of the Orientos Anticline, a north-west–south-east trending closed structure mapped solely by seismic survey. The seismic reflecting horizons had been traced from the previously established section at Dullingari No. 1. The drilling contractor was Drilling Contractors (Australia) Pty. Ltd., and the drilling rig a National 80B. Kelly bushing elevation was 474 ft., and ground elevation 459 ft. Drilling commenced on 11th October, 1962, and was completed at total depth of 11,527 ft. on 17th December, 1962. The operation was subsidized by the Commonwealth Government.

Twenty-six-inch hole was drilled from surface to 99 ft., and 20-in. 94-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was drilled from 99 ft. to 1,220 ft., and 13⅜-in. 48-lb. casing was set to 1,219 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 1,220 ft. to 5,383 ft., and 9⅝-in. 36-lb. casing was set to 5,379 ft. and cemented to 3,600 ft. Eight and one-half-inch hole was drilled from 5,383 ft. to total depth.

Twenty-three cores were cut, ten conventional and thirteen diamond. Total footage cored was 215 ft., and total recovery 171¼ ft. (or 79·8 per cent.). Forty-one sidewall cores were taken between 5,510 ft. and 7,280 ft. The following Schlumberger logs were run:

Electric Log	100–11,539 ft.
Induction Electric Log	100– 7,290 ft.
Caliper	100–11,539 ft.
Microlog	100– 2,396 ft., 4,000–8,449 ft.
Sonic Log	1,220–11,529 ft.
Gamma Ray Log	20–11,536 ft.
Continuous Dipmeter	5,418–11,540 ft.
Temperature Log	200–11,540 ft.

Deviation surveys were run, the maximum deviation being 9¼°. A velocity survey was run, a drilling-rate log kept, and a continuous gas-detection unit maintained.

The stratigraphic succession was reported as—

Surface–302 ft.	Recent and Tertiary
302– 2,200 ft.	Winton Formation
2,200– 3,014 ft.	Tambo Formation
3,014– 4,075 ft.	Roma Formation
4,075– 4,373 ft.	Transition Beds
4,373– 5,050 ft.	Mooga Sandstone
5,050– 5,553 ft.	Walloon Formation
5,553– 5,964 ft.	Lower Triassic
5,964– 7,288 ft.	Upper Permian
5,964–6,575 ft.	Upper Sandstone Unit
6,575–6,900 ft.	Upper Shale Unit
6,900–7,020 ft.	Middle Sandstone Unit
7,020–7,288 ft.	Lower Shale Unit
7,288–11,527 ft.	Ordovician Shale

The Ordovician section lies unconformably beneath the Permian. The stratigraphic penetration in this section was approximately 2,456 ft. in 4,239 ft. of hole.

Traces of methane were reported from the Blythesdale Formation, and small amounts of oily material were extracted from Permian black shales. No formation testing was carried out.

A cement plug was set between 5,243 ft. and 5,593 ft., the casing perforated, and the well was completed as a water well to produce from the Blythesdale Formation, on 21st December, 1962.

Exoil Brookwood No. 1

This well was located at lat. 22°28′55″ S., long 144° 19′58″ E., 15 miles north-west from Muttaburra. Drilling was designed as a structural test of the seismically-determined, northward-plunging Brookwood Anticline and as a stratigraphic test of this part of the Eromanga Basin. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a National T32. Kelly bushing elevation was 746 ft., and ground elevation 735 ft. Drilling commenced on 10th October, 1962, and was completed at total depth of 4,806 ft. on 1st November, 1962. The operation was subsidized by the Commonwealth Government.

Twelve and one-quarter-inch hole was drilled from surface to 412 ft., and 9⅝-in. 40-lb. casing was set to 402 ft. and cemented to surface. Eight and one-half-inch hole was drilled from 412 ft. to 4,803 ft. and 5½-in. hole from 4,803 ft. to 4,806 ft.

Fifteen conventional cores were cut between 506 ft. and 4,806 ft., coring a total of 162 ft., and recovering 108½ ft. (or 67 per cent.). Schlumberger ran an electric log between 405–4,808 ft., a microcaliper log between 2,000–4,806 ft. and a gamma-ray log between 100–4,806 ft. Mines Administration Pty. Ltd. ran a Failing Logmaster electric log between 402–2,345 ft. Deviation surveys and a velocity survey were run, a drilling-rate log kept and a Rotary gas-detection unit maintained.

The stratigraphic succession was reported as—

Surface–290 ft.	Winton Formation
290–1,460 ft.	Upper Wilgunya Formation
1,460–1,530 ft.	Toolebuc Member
1,530–2,085 ft.	Lower Wilgunya Formation
2,085–2,468 ft.	Blythesdale Group
2,468–2,674 ft.	Walloon Formation equivalent
2,674–2,988 ft.	Bundamba Formation
2,988–3,417 ft.	Brookwood Beds
3,417–4,796 ft.	Permian
4,796–4,806 ft.	Granite (basement)

The term "Brookwood Beds" is used by the company to identify 429 ft. of Lower Triassic sandstones, siltstones and shales encountered in this well. The Permian section consists of sandstone, siltstone, shale and coal. The basal 56 ft. is arkosic in nature.

Traces of gas were detected in the Toolebuc Member and in the Lower Wilgunya Formation. Fluorescence was noted in the Brookwood Beds, and several gas shows in the Permian (associated with coal seams). Porous sandstones in the Permian and Mesozoic were found to be water bearing. One drill-stem test was conducted.

D.S.T. No. 1 (3,595–3,889 ft.) Recovered fresh water.

Cement plugs were set between 4,630–4,780 ft., 3,950–4,100 ft., 3,000–3,150 ft., 2,350–2,500 ft., 1,930–2,080 ft., 325–475 ft. and surface—20 ft. The well was abandoned as a dry hole on 3rd November, 1962.

Nortex Australian Oils Jambin No. 1

This well was drilled on A. to P. 78P, and was located at lat. 24°11′ S., long. 150°25′ E., about 14 miles north-north-west from Biloela. It was drilled on the crestal area of the Jambin Anticline, a closed, north-west–south-east trending anticlinal structure, about 5 miles long and 2¼ miles across, which had been determined by air photo interpretation, surface geological work and bore data examination. The drilling was designed as a test of this structure, and as a stratigraphic test of the Permian section. The drilling contractor was Price Anderson Pty. Ltd., using a Failing 2,500 rotary rig. Ground elevation was 510 ft., and rotary table elevation was 514½ ft. Drilling commenced on 17th March, 1962, and was completed on 31st March, when total depth of 540 ft. was reached. The work was subsidized by the Commonwealth Government.

Hole size was 8¾ in. from surface to 210 ft., and 5½ in. from 210 ft. to total depth. Six and five-eighths-inch 20-lb. casing was set to 200 ft., and cemented to surface.

One core was taken between 515 ft. 10 in. and 518 ft. 7 in. There was no well logging, other than lithological and drilling-rate logging. No oil or gas shows were reported.

The stratigraphic succession was reported to be—

0– 40 ft.	Quaternary alluvium
40–210 ft.	Tertiary clay
210–400 ft.	Neimen Formation (middle Permian)
400–540 ft.	Camboon Andesite (lower Permian)

The hole was capped and the well abandoned on 31st March, 1962.

Nortex Australian Oils Jambin No. 2

This well was drilled at lat. 24°11′30″ S., long. 150°24′20″ E., 1 mile south-west of Nortex Jambin No. 1, and was located on the flank of the Jambin Anticline. The drilling contractor was Price Anderson Pty. Ltd., using a Failing 2,500 rotary rig. Ground elevation was 490 ft., and rotary table elevation was 494½ ft. The well was spudded on 1st April, 1962, and reached total depth of 843 ft. on 10th April. The work was subsidized by the Commonwealth Government.

Hole size was 8¾ in. from surface to 64 ft., and 5½ in. from there to total depth. Six-inch 12.43-lb. water bore casing was set to 64 ft., and cemented at the surface.

One core was taken at 836–843 ft. with 2 ft. being recovered. Lithological and drilling-rate logs only were prepared. There were no oil or gas shows.

The section penetrated was reported to be:—

0– 60 ft.	Quarternary alluvium
60–320 ft.	Tertiary clay
320–460 ft.	Permian
460–780 ft.	Neimen Formation
780–843 ft.	Camboon Andesite

Palynological work by P. R. Evans of the B.M.R., however, showed no sign of a pre-Cainozoic microflora, and he considered all the sediments above the andesite to be Cainozoic in age.

The well was capped and abandoned on 11th April, 1962.

Oil Development Maranda No. 1

This well was located at lat. 23°12′14″ S., long. 145°26′40″ E., about 25 miles north-north-east from Barcaldine. It was drilled as a test of the petroleum possibilities of the Maranda Structure which had been established by geophysical methods. The drilling contractor was Reading and Bates (Australia) Pty. Ltd., and the drilling rig was a National 75. Kelly bushing elevation was 862 ft., and ground elevation 850 ft. Drilling commenced on 19th September, 1962 and total depth of 6,491 ft. was reached on 30th December, 1962. The work was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled from surface to 23ft., and 20-in. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was drilled from 23 ft. to 1,015 ft., when 13⅜-in. 48-lb. casing was set to 1,014 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 1,015 ft. to 2,509 ft., 8¾-in. hole from 2,509 ft. to 6,231 ft., 8½-in. hole from 6,231 ft. to 6,479 ft. and 6⅛-in. hole from 6,479 ft. to 6,491 ft.

Twenty-five cores, both conventional and diamond, were taken, coring 379 ft. and recovering 310 ft. (or 81.8 per cent). Schlumberger ran electric logs from 78 ft. to 6,493 ft., microlog-caliper logs from 1,013 ft. to 6,483 ft., and a sonic-caliper log from 1,014 ft. to 6,485 ft. A drilling-time log was kept, and deviation surveys were conducted.

The stratigraphic section penetrated in the well was reported to be:—

40– 180 ft.	Roma Formation
180– 356 ft.	Blythesdale Group equivalent
356– 858 ft.	Bundamba Group
858–1,367 ft.	Moolayember Formation
1,367–1,764 ft.	Clematis Sandstone
1,764–2,396 ft.	Rewan Formation equivalent
2,396–2,640 ft.	Bandanna Formation
2,640–5,815 ft.	Colinlea Formation
	2,640–3,170 ft. Upper Sandstone Member
	3,170–3,668 ft. Shale Member
	3,668–5,815 ft. Lower Sandstone Member
5,815–6,465 ft.	Joe Joe Creek Formation
6,465–6,493 ft.	Upper Proterozoic or Lower Palaeozoic

No indications of petroleum were recorded. Seven drill stem tests were conducted to evaluate porous sandstones. The results of these tests are summarized below:—

D.S.T. No. 1	(3,486–3,521 ft.) Recovered watery mud
D.S.T. No. 2	(3,663–3,698 ft.) Recovered fresh water
D.S.T. No. 3	(3,775–3,810 ft.) Recovered fresh water
D.S.T. No. 4	(4,479–4,514 ft.) Recovered fresh water
D.S.T. No. 5	(4,744–4,780 ft.) Recovered fresh water
D.S.T. No. 6	(5,062–5,100 ft.) Recovered fresh water
D.S.T. No. 7	(6,056–6,086 ft.) Recovered fresh water

Cement plugs were set between 5,050–5,200 ft., 4,240–4,390 ft., 3,250–3,400 ft., 1,850–2,000 ft., 900–1,050 ft. and 0–15 ft., and the well was abandoned on 15th January, 1963.

Phillips–Sunray Etonvale No. 1

This well was located at lat. 25°09′40″ S., long. 144°59′40″ E., 58 miles south-south-west from Blackall. The well was drilled as a test (on a structure determined by seismic methods) of the Palaeozoic section which unconformably underlies the Mesozoic section of the Great Artesian Basin. The drilling contractor was Delta Drilling Co., and the rig a National 130. Rotary table elevation was 1,097 ft., and ground elevation 1,083 ft. The well was spudded on 27th September, 1961, and total depth of 11,368 ft. was reached on 12th March, 1962. The work was subsidized by the Commonwealth Government.

Seventeen and one-half-inch hole was drilled from surface to 800 ft., and 13⅜-in. 48-lb. surface casing was set to 798 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 800 ft. to 5,670 ft., and 9⅝-in. 40-lb. and 36-lb. casing was set to 5,644 ft. and cemented to 2,730 ft. Eight and five-eighths-inch hole was drilled from 5,670 ft. to total depth.

Thirty conventional cores were cut between 2,490 ft. and 11,368 ft., coring in all 303 ft. Twenty-six cores, of total length 191 ft. were recovered (63 per cent. recovery). Twenty-seven sidewall cores were recovered between 1,103 ft. and 1,926 ft., and nine sidewall cores between 5,725 ft. and 6,921 ft. Wireline logging was carried out by Welex. The following logs were run:—

Induction Electric	796 ft.–total depth
Guard	796 ft.–total depth
FoRxo/Caliper	797 ft.–total depth
Acoustic Velocity	50 ft.–total depth
Radioactivity	50 ft.–total depth
Dipmeter	5,250 ft.–total depth
Caliper	16 ft.–9,450 ft.
Temperature	600 ft.–5,610 ft.; 8,000 ft.–9,000 ft.

Core Laboratories Inc. maintained a continuous gas-detection unit and logging service. Deviation surveys were made at frequent intervals.

The stratigraphic section encountered was reported as:—

Surface–	22 ft.	Recent	
22–	1,353 ft.	Winton Formation	
1,353–	1,826 ft.	Upper Tambo Formation	
1,826–	2,472 ft.	Lower Tambo Formation	
2,472–	3,386 ft.	Roma Formation	
3,386–	3,633 ft.	Transition Beds	Blythesdale Group
3,633–	4,330 ft.	Mooga Formation	
4,330–	4,655 ft.	Fossil Wood Beds	
4,655–	5,058 ft.	Gubberamunda Formation	
5,058–	5,534 ft.	Lower Jurassic	
5,534–	5,646 ft.	Upper Permian	
5,646–	6,267 ft.	Lower Permian	
6,267–	6,804 ft.	Middle Devonian, D–1 unit	
6,804–	7,532 ft.	Middle Devonian, D–2 unit	
7,532–	7,662 ft.	Middle Devonian, D–3 unit	
7,662–	8,212 ft.	Lower Devonian, D–4 unit	
8,212–	9,540 ft.	Lower Devonian, D–5 unit	
9,540–10,030 ft.		Silurian, S–1 unit	
10,030–11,160 ft.		Silurian, S–2 unit	
11,160–11,368 ft.		Granite (Upper Silurian)	

The unnamed formations below 5,058 ft. have been described by the company as consisting of—

Lower Jurassic.—Sandstone with minor interbedded silty shale; freshwater

Upper Permian.—Sandstone, overlain and underlain by black shale

Lower Permian.—Shale with interbedded sandstone and siltstone to 5,990 ft.; sandstone with interbedded shale below 5,990 ft. — continental

D–1 unit.—Sandstone with minor shale

D–2 unit.—Sandstone with interbedded shale

D–3 unit.—Dolomite, with interbedded dolomitic sandstone

D–4 unit.—Sandstone with interbedded claystone

D–5 unit.—Sandstone with interbedded shale — shallow marine and continental

S–1 unit.—Quartzose sandstone with interbedded shale; marine

S–2 unit.—Arkosic sandstone with interbedded mudstone and shale and some tuff.

There is an unconformity at 6,267 ft., between Permian and Devonian rocks.

There were no oil or gas indications. Seventeen drill-stem tests were conducted, the results of which are summarized below:—

D.S.T. 1	(3,875– 4,076 ft.)	Recovered fresh water
D.S.T. 2	(4,374– 4,422 ft.)	Recovered fresh water
D.S.T. 3	(5,649– 5,730 ft.)	Recovered water-cut mud
D.S.T. 4	(7,663– 7,739 ft.)	Recovered salt water
D.S.T. 5	(8,477– 8,535 ft.)	Misrun
D.S.T. 6	(8,476– 8,542 ft.)	Recovered drilling mud
D.S.T. 7	(9,853–10,051 ft.)	Misrun
D.S.T. 8	(9,832–10,051 ft.)	Misrun
D.S.T. 9	(9,901–10,051 ft.)	Misrun
D.S.T. 10	(9,621– 9,780 ft.)	Misrun
D.S.T. 11	(9,493– 9,780 ft.)	Misrun
D.S.T. 12	(9,493– 9,780 ft.)	Misrun
D.S.T. 13	(9,315– 9,480 ft.)	Misrun
D.S.T. 14	(8,400– 8,690 ft.)	Misrun
D.S.T. 15	(8,400– 8,652 ft.)	Misrun
D.S.T. 16	(6,120– 6,150 ft.)	Recovered brackish water
D.S.T. 17	(5,643– 5,999 ft.)	Recovered brackish water

The well was plugged by setting cement plugs between 10,065–10,245 ft., 9,780–9,970 ft., 9,480–9,602 ft., 8,800–8,893 ft., 8,652–8,795 ft., 7,497–7,720 ft., 6,150–6,357 ft., 5,999–6,138 ft., 5,573–5,687 ft. and 5–40 ft., and the hole was abandoned on 10th April, 1962.

Phillips-Sunray Gumbardo No. 1

This well was located at lat. 25°58′52″ S., long. 144°41′41″ E., 9 miles east-south-east from Adavale. The well was designed as a test of the marine Devonian section encountered during the drilling of Phillips-Sunray Etonvale No. 1 (60 miles to the north-east), on the crest of the Gumbardo Anticline, a seismically-determined south-south-east trending closure. The drilling contractor was Delta Drilling Company, and the drilling rig a National 130B. Kelly bushing elevation was 930 ft., and ground elevation 916 ft. Drilling commenced on 6th May, 1962, and reached total depth of 12,940 ft. on 28th October, 1962. The operation was subsidized by the Commonwealth Government.

Seventeen and one-half-inch hole was drilled from surface to 815 ft., and 13⅜-in. 48-lb. casing was set to 808 ft., and cemented to surface. Twelve and one-quarter-inch hole was drilled from 815 ft. to 5,525 ft., and 9⅝-in. 36-lb. and 40-lb. casing was set to 5,519 ft. and cemented to 172 ft. Eight and five-eighths-inch hole was drilled from 5,525 ft. to total depth.

Seventeen conventional and diamond cores were cut. A total footage of 195 ft. was cored, with recovery of 163·2 ft. (or 83 per cent.). Twenty-one sidewall cores were recovered between 4,411 ft. and 5,420 ft. Welex ran wireline logs over the following intervals:—

Induction–Electric	60 ft.–total depth
Guard	813 ft.–total depth
FoRxo–Caliper	813 ft.–total depth
Acoustic Velocity	813 ft.–total depth
Radioactivity	50 ft.–total depth
Dipmeter	7,500 ft.–total depth
Temperature	Surface–5,517 ft.

Deviation surveys and a velocity survey were run. Core Laboratories provided a logging service and a continuous gas-detection unit was maintained.

The stratigraphic succession was reported to be—

Surface–	115 ft.	Tertiary laterite	
115–	790 ft.	Winton Formation	
790–	1,875 ft.	Tambo Formation	
1,875–	2,792 ft.	Roma Formation	
2,792–	3,886 ft.	Blythesdale Formation	
	2,792–3,084 ft.	Transition Member	
	3,084–3,886 ft.	Sandstone Member ("Mooga Sandstone")	
3,886–	4,124 ft.	Walloon Formation	
4,124–	4,728 ft.	Hutton Formation	Adavale Group
4,728–	8,084 ft.	Buckabie Formation	
8,084–10,393 ft.		Etonvale Formation	
10,393–12,835 ft.		Gumbardo Formation	
12,835–12,940 ft.		Olivine basalt (Ordovician)	

The Adavale Group is proposed by Phillips Petroleum Company for rocks of Palaeozoic age occurring subsurface in the Adavale Basin. The group, which unconformably underlies the Mesozoic section in this well, is divided into the Buckabie Formation, a red-bed sequence of sandstone and shale, the Etonvale Formation of sandstone, shale and carbonate sediments and the Gumbardo Formation of predominantly acid welded tuff, lithic tuff, and recyrstallized crystal tuff.

Slight methane indications were recorded from the Blythesdale Formation. Otherwise no oil or gas shows or fluorescence were detected. Eight drill-stem tests were conducted, the results being summarized below—

D.S.T. No. 1	(3,483–3,580 ft.)	Misrun
D.S.T. No. 2	(3,483–3,580 ft.)	Recovered fresh water
D.S.T. No. 3	(5,050–5,228 ft.)	Recovered mud and muddy water
D.S.T. No. 4	(8,285–8,374 ft.)	Misrun
D.S.T. No. 5	(8,332–8,424 ft.)	Recovered drilling mud
D.S.T. No. 6	(9,111–9,339 ft.)	Misrun
D.S.T. No. 7	(9,086–9,339 ft.)	Recovered drilling mud
D.S.T. No. 8	(9,060–9,339 ft.)	Recovered mud and salt water

Cement plugs were set between 10,400–10,550 ft., 9,670–9,820 ft., 8,950–9,100 ft., 5,400–5,575 ft. and in the top of the casing, and the well was abandoned on 1st November, 1962.

Phillips–Sunray Black Mountain No. 1

This well was located at lat. 22°32′30″ S., long. 140°17′ E., 38 miles north-east from Boulia. Drilling was designed as a stratigraphic test of the Cambrian and Ordovician sections in the Boulia Basin, and to determine the petroleum potential of the area. The well was drilled on a half dome truncated by a fault to the east, the structure being indicated by surface outcrop. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a National T32. Kelly bushing elevation was 861 ft., and ground elevation 850 ft. Drilling commenced on 14th July, 1962, and was completed on 19th October, 1962, at total depth 5,511 ft. The work was subsidized by the Commonwealth Government.

Hole size was 12¼ in. from surface to 410 ft., 8¾ in. from 410 ft. to 4,042 ft. and 8⅝ in. from 4,042 ft. to total depth. Nine and five-eights-inch 36-lb. casing was set to 396 ft. and cemented to surface.

Twenty conventional and diamond cores were cut, coring 155½ ft. with 82 per cent. (representing 127 ft. 4 in.) core recovery. Welex ran wireline logs over the following intervals:—

Induction—Electric	404–5,506 ft.
Guard	405–5,505 ft.
FoRxo-Caliper	406–5,508 ft.
Radioactivity	50–5,510 ft.
Acoustic Velocity	406–5,506 ft.
Continuous Dipmeter	1,400–5,507 ft.

Deviation surveys were run, the maximum deviation being 9° at 3,475–3,658 ft. A drilling-rate log was kept, and a Core Laboratories continuous gas-detection unit maintained.

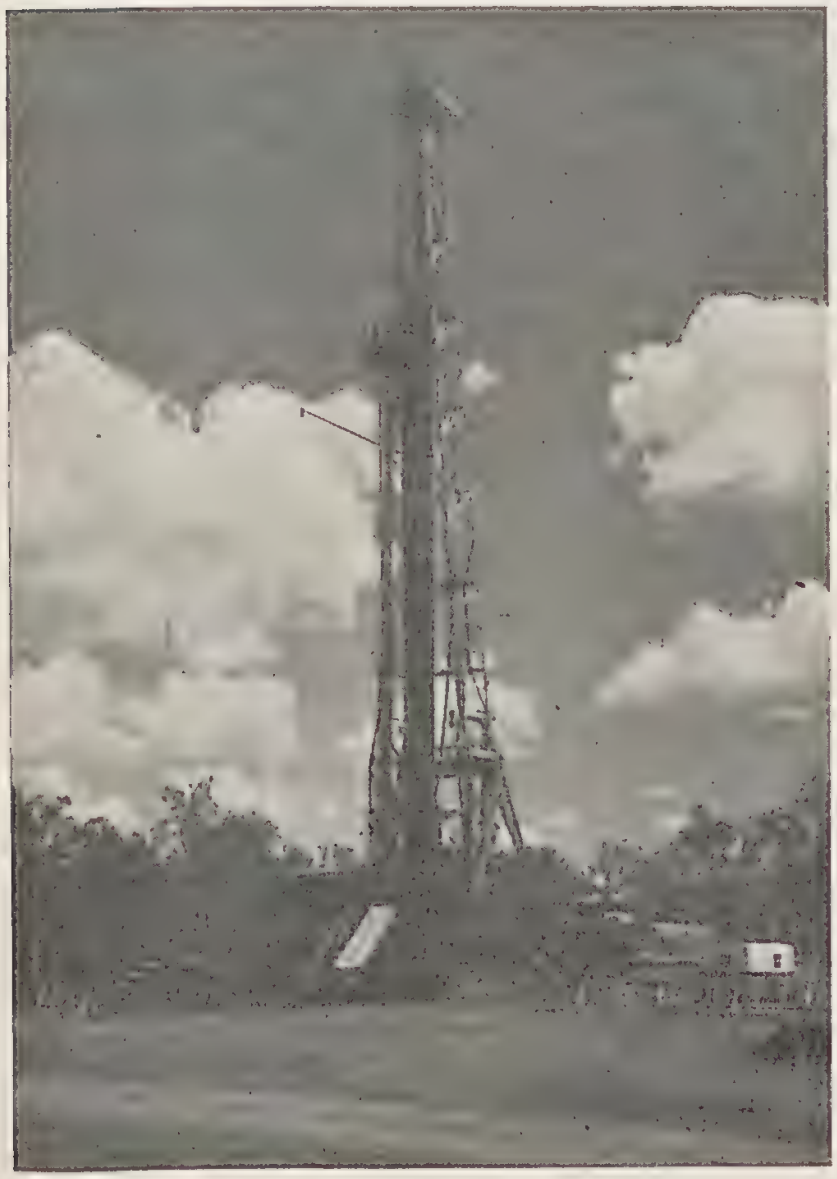
The company reported the stratigraphic succession to be—

Surface–590 ft.	Chatsworth Limestone
590– 752 ft.	O'Hara Shale
752–1,569 ft.	Pomegranate Limestone
1,569–3,341 ft.	Limestone and shale (?equivalent to Inca Formation)
3,341–3,828 ft.	Limestone and siltstone (?equivalent to Beetle Creek Formation)
3,828–4,266 ft.	Mount Birnie Sandstone
	3,828–3,930 ft. Sandstone Member
	3,930–4,036 ft. Green Shale Member
	4,036–4,266 ft. Shale and Sandstone Member
4,266–5,511 ft.	Shale (Upper Proterozoic?)

No shows of oil or gas or indications of petroleum were recorded. However, cores 6 (1,704–1,714 ft.) and 7 (1,931–1,941 ft.) had a bituminous odour when broken. Four drill-stem tests, the results of which are summarized below, were conducted.

D.S.T. No. 1 (1,689–2,072 ft.) Misrun, packer failed
D.S.T. No. 2 (1,679–2,072 ft.) Misrun, packer failed
D.S.T. No. 3 (1,700–2,072 ft.) Misrun, packer failed
D.S.T. No. 4 (1,781–2,072 ft.) Recovered fresh water

Cement plugs were set between 1,800–2,000 ft., 325–475 ft. and 0–30 ft., and the well was abandoned on 21st October, 1962.

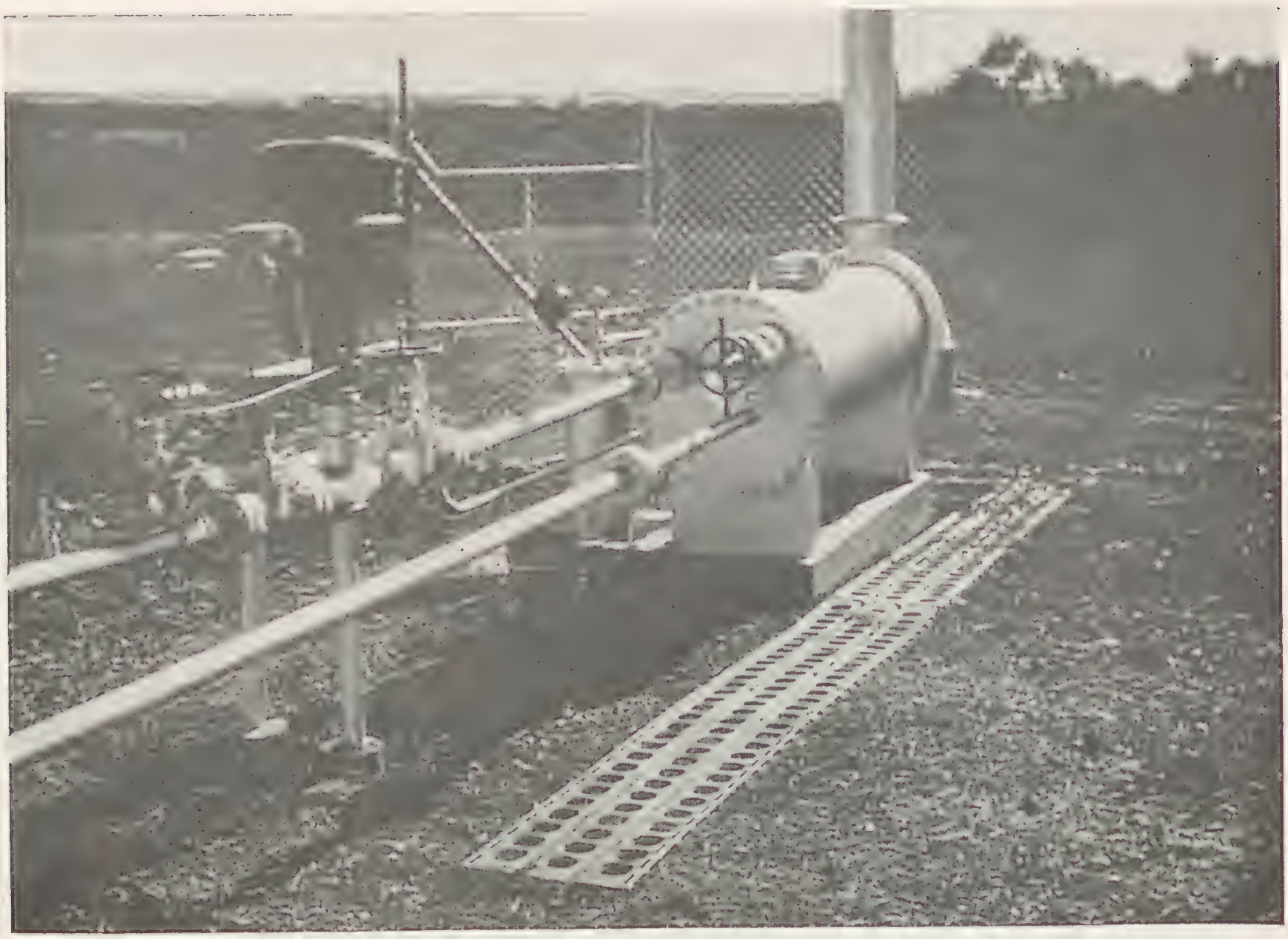


National 55 Drilling Rig, Sunnybank Area.

—Photo, courtesy Mines Administration Pty. Ltd.

Cabot-Blueberry Marina No. 1 Well, National T32 Drilling Rig.

—Photo, courtesy Cabot Corporation.



Gas Treatment Plant, A.A.O. Timbury Hills No. 2 Well, Roma.

—Photo, courtesy Mines Administration Pty. Ltd.

Phillips-Sunray-Queensland American Durabilla No. 1

This well was located at lat. 27°33′00″ S., long. 150°51′45″ E., 20 miles west from Cecil Plains. The well was designed primarily as a test of the Bundamba Formation on the structurally-highest closure on the south-west plunging nose of the Durabilla Anticline, a structure outlined by photogeological mapping and detailed by seismic methods. The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig a National T32. Kelly bushing elevation was 1,268 ft., and ground elevation 1,257 ft. Drilling commenced on 16th July, 1962, and ceased at total depth of 4,358 ft. on 31st July, 1962. The operation was subsidized by the Commonwealth Government.

Seventeen and one-half-inch hole was drilled from surface to 795 ft., and 13⅜-in. 48-lb. casing was set to 792.3 ft. and cemented to surface. Eight and three-quarter-inch hole was drilled from 795 ft. to total depth.

Fifteen cores, both conventional and diamond, were cut between 1,757 ft. and total depth, coring a total of 105.5 ft., and recovering 89·9 ft. (or 85 per cent.). Wireline logs were run by Welex over the following intervals:—

Induction—Electric	50–4,305 ft.
Guard	100–3,780 ft.
Contact	50– 792 ft.
FoRxo–Caliper	789–2,782 ft.
FoRxo	2,792–3,782 ft.
Radioactivity	50–4,309 ft.
Caliper	50–780 ft., 790–4,306 ft.
Acoustic Velocity	100–4,305 ft.

Deviation surveys, a velocity survey and a drilling-time log were made. A Core Laboratories continuous gas-detection unit was maintained.

The company reported the stratigraphic succession to be—

Surface–1,275 ft.	Blythesdale Formation
1,275–2,528 ft.	Walloon Formation
2,528–3,330 ft.	Upper Bundamba Sandstone
3,300–3,590 ft.	Middle Bundamba Shale
3,590–3,744 ft.	Lower Bundamba Sandstone
3,744–4,358 ft.	Carboniferous sandstones, conglomerates, siltstones and shales

No oil or gas shows were reported. Two drill-stem tests were conducted, the results being summarized below—
D.S.T. No. 1 (3,020–3,113 ft.) Recovered fresh water
D.S.T. No. 2 (3,607–3,665 ft.) Recovered watery mud; zone impermeable.

The hole was plugged by setting cement plugs between 4,100–4,356 ft., 3,515–3,787 ft., 2,870–3,150 ft., 2,390–2,810 ft., 1,160–1,355 ft., 742–1,089 ft. and in the top of the casing, and the well was abandoned on 1st August, 1962.

Phillips-Sunray-Queensland American Kogan No. 1

This well was located at lat. 27°05′16″ S., long. 150°47′55″ E., 4 miles south-east from Kogan. It was drilled on the largest and northernmost culmination of the Kogan Structure which was mapped by photogeological and seismic methods. The drilling contractor was Oil Drilling and Exploration Ltd., using a National T-32 drilling rig.

Kelly bushing elevation was 1,237 ft., and ground elevation 1,226 ft. Drilling commenced on 12th August, 1962, and total depth of 3,437 ft. was reached on 30th August, 1962. The work was subsidized by the Commonwealth Government.

Seventeen and one-half-inch hole was drilled from surface to 698 ft., when 13⅜-in 48-lb. casing was set to 693 ft. and cemented to surface. Eight and three-quarter-inch hole was drilled from 698 ft. to total depth.

Five conventional cores were taken, coring 65 ft. and recovering 58 ft. (or 89 per cent.). Welex wireline logs were run over the following intervals:—

Induction-Electric	..	50–3,434 ft.
Guard	..	710–3,433 ft.
Contact Caliper	..	50– 697 ft., 2,000–3,403 ft.
Acoustic ..	..	50–3,433 ft.
Radioactivity ..	..	50–3,437 ft.
Caliper ..	..	50– 696 ft., 2,050–2,957 ft.

Deviation and velocity surveys were also conducted. A drilling-time log was kept, and a Core Laboratories gas-detection unit maintained.

The company reported the stratigraphic succession to be—

Surface–320 ft.	Blythesdale Formation
320–1,753 ft.	Walloon Formation
1,753–2,550 ft.	Upper Bundamba Formation
2,550–2,889 ft.	Middle Bundamba Formation
2,889–3,340 ft.	Lower Bundamba Formation
3,340–3,437 ft.	Basement (basalt)

Three drill-stem tests were conducted to test the Bundamba Formation. The results are summarized as—

D.S.T. No. 1. (1,886–2,092 ft.) Recovered fresh water
D.S.T. No. 2. (2,889–2,961 ft.) Recovered drilling mud
D.S.T. No. 3. (3,247–3,407 ft.) Recovered fresh water

Cement plugs were set between 3,000–3,200 ft., 2,550–2,750 ft., 2,000–2,200 ft., 1,500–1,700 ft., 590–750 ft., and at the top of the surface pipe. The well was abandoned on 1st September, 1962.

Phillips-Sunray-Queensland American Kogan South No. 1

This well was located at lat. 27°08′40″ S., long. 150°48′08″ E., 7½ miles south-south-east from Kogan, and 4 miles south-south-east from Phillips-Sunray-Queensland American Kogan No. 1. The well was drilled on the upthrown southern side of an east-north-east trending fault across the southward plunging Kogan Anticline. The Kogan structure had previously been determined by photogeological and seismic methods and tested by the drilling of Kogan No. 1. It was considered that the transverse fault barrier, in conjunction with closure, might provide a more suitable trap for petroleum accumulation.

The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig a National T-32. Kelly bushing elevation was 1,209 ft., and ground elevation 1,198 ft. Drilling commenced on 19th September, 1962, and reached total depth of 3,519 ft. on 6th October, 1962. The work was subsidized by the Commonwealth Government.

Seventeen and one-quarter-inch hole was drilled from surface to 790 ft., and 8¾-in. hole from 790 ft. to total depth. Thirteen and three-eighths-inch 48-lb. casing was set to 781.6 ft. and cemented to surface.

Seven conventional cores were cut between 3,066–3,519 ft., in the Bundamba Sandstone and one in basement. Footage cored was 79 ft., and recovery 74.3 ft., representing 83.5 per cent. Welex wireline logs were run over the following intervals:—

Induction-Electric	.. ..	50–3,514 ft.
Contact-Caliper	.. ..	50–3,518 ft.
Guard	.. ..	779–3,514 ft.
Acoustic Velocity	.. ..	779–3,514 ft.
Radioactivity ..	.. ..	50–3,519 ft.
Caliper	.. ..	10– 786 ft.

A Core Laboratories continuous gas-detection unit was maintained. Deviation surveys and a velocity survey were conducted.

The company reported the stratigraphic succession to be—

Surface– 15 ft.	Recent
15– 464 ft.	Blythesdale Formation
464–1,857 ft.	Walloon Formation
1,857–2,630 ft.	Upper Bundamba Sandstone
2,630–2,967 ft.	Middle Bundamba Shale
2,967–3,428 ft.	Lower Bundamba Sandstone
3,428–3,519 ft.	Basalt

No indications of hydrocarbons, apart from minor gas shows in the Walloon Formation, were encountered. Two drill-stem tests were conducted in the Bundamba Formation.

The results are summarized below—

D.S.T. No. 1. (1,851–2,054 ft.) Recovered fresh water
D.S.T. No. 2. (3,332–3,391 ft.) Recovered fresh water

The well was plugged by setting cement plugs between 3,100–3,300 ft., 2,780–2,980 ft., 2,050–2,250 ft., 1,650–1,850 ft., 700–850 ft. and in the top of the casing. The well was abandoned on 8th October, 1962.

Phillips-Sunray Canary No. 1

This well was located at lat. 23°15′30″ S., long. 140° 22′30″ E., 38 miles south-east from Boulia. Drilling was designed as a stratigraphic test to determine the nature of a thick section indicated by seismic reflections. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a National T-32. Kelly bushing elevation was 526 ft., and ground elevation was 515 ft. Drilling commenced on 1st November, 1962, and was completed at total depth of 3,218 ft. on 24th November. The work was subsidized by the Commonwealth Government.

Hole size was 12¼ in. from surface to 585 ft., 8¾ in. from 585 ft. to 2,900 ft., and 8⅝ in. from 2,900 ft. to total depth. Nine and five-eighths-inch 36-lb. casing was set to 569 ft. and cemented to surface.

Seven conventional and diamond cores were cut, coring a total footage of 49 ft., and recovering 44 ft. 3 in. (or 90 per cent. core recovery). Welex ran wireline logs over the following intervals:—

Induction—Electric	.. .. ..	569–3,213 ft.
Guard	.. .. ..	569–3,212 ft.
FoRxo–Caliper ..	.. .. ..	569–3,214 ft.
Radioactivity ..	.. .. ..	50–3,217 ft.
Acoustic Velocity	.. .. ..	569–3,213 ft.
Dipmeter ..	.. .. ..	569–3,214 ft.

Deviation surveys were run, a drilling-rate log kept, and a Core Laboratories continuous gas-detection unit maintained.

The company reported the stratigraphic succession to be—

Surface–472 ft.	Wilgunya Formation.
472– 504 ft.	Longsight Sandstone.
504–2,530 ft.	Shale (Upper Proterozoic ?).
2,530–2,688 ft.	Shale (Upper Proterozoic ?).
2,688–3,218 ft.	Arkose (Upper Proterozoic ?).

No shows of oil or gas or indications of petroleum were reported, little porosity was encountered and no tests were made.

Cement plugs were set between 516–648 ft. and in the top of the surface casing. The well was abandoned on 27th November, 1962.

Phillips-Sunray Beantree No. 1

This well was located at lat. 22°45′ S., long. 140°05′ E., 18 miles north-east from Boulia. The well was drilled as a stratigraphic test on a mapped gravity low, where a thick section was expected. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a National T32. Kelly bushing elevation was 571 ft., and ground elevation 560 ft. Drilling commenced on 3rd December, 1962, and was completed at total depth of 2,064 ft. on 16th December, 1962. The operation was subsidized by the Commonwealth Government.

Hole size was 12¼ in. from surface to 396 ft., 8¾ in. from 396 ft. to 1,431 ft., and 8⅝ in. from 1,431 ft. to total depth. Nine and five-eighths-inch 36-lb. casing was set to 378 ft. and cemented to surface.

Five conventional and diamond cores were cut, coring 37 ft. and recovering 28 ft. 3 in. (or 76 per cent.). Welex ran wireline logs over the following intervals:—

Guard	388–2,056 ft.
FoRxo–Caliper	388–2,058 ft.
Radioactivity	20–2,061 ft.
Acoustic Velocity	388–2,057 ft.

Deviation surveys were run, a drilling-rate log was kept, and a Core Laboratories continuous gas-detection unit maintained.

The company reported the stratigraphic succession to be—

Surface–303 ft.	Wilgunya Formation
303–1,604 ft.	Pomegranate Limestone
1,604–1,740 ft.	Limestone (Lower Middle Cambrian)
1,740–1,926 ft.	Adamellite (Lower Proterozoic ?)
1,926–2,064 ft.	Amphibolite (Lower Proterozoic ?)

There were no oil or gas shows and no indications of petroleum. No testing was carried out.

Cement plugs were set between 325–465 ft., and in the top of the casing. The well was abandoned on 17th December, 1962.

Phillips-Sunray Elizabeth Springs No. 1

This well was located at lat. 23°21′ S., long. 140°36′ E., 55 miles south-east from Boulia. The well was located on a faulted dome indicated by surface outcrop, and was designed as a stratigraphic test of the area which had also been mapped as a closed gravity high. The drilling contractor was Richter-Bawden Drilling Pty. Ltd., and the drilling rig a National T32. Kelly bushing elevation was 498 ft., and ground elevation 487 ft. Drilling commenced on 24th December, 1962, and was completed at total depth of 1,410 ft. on 11th January, 1963. The work was subsidized by the Commonwealth Government.

Hole size was 12¼ in. from surface to 410 ft., 8⅝ in. from 410 ft. to 1,400 ft., and 7⅞ in. from 1,400 ft. to total depth. Nine and five-eighths-inch 36-lb. casing was set to 399 ft. and cemented to surface.

Three conventional and diamond cores were cut, coring 23 ft. for recovery of 5 ft. 3 in. (or 23 per cent.). Welex ran wireline logs over the following intervals:—

Guard	399–1,404 ft.
Radioactivity	30–1,409 ft.
Acoustic Velocity	399–1,405 ft.
Dipmeter	399–1,409 ft.

Deviation surveys were run, a drilling-rate log kept and a Core Laboratories continuous gas-detection unit maintained.

The company reported the stratigraphic succession to be—

Surface–134 ft.	Wilgunya Formation
134– 383 ft.	Longsight Sandstone
383–1,410 ft.	Shale (Upper Proterozoic ?)

There were no oil or gas shows and no indications of petroleum. No tests were conducted.

A cement plug was set from 380–450 ft., and a 2-in. gate valve placed on the surface casing. The well was abandoned on the 13th January, 1963.

Smart Oil Orient No. 2

(The drilling of this well commenced during 1961, and a progress report was made in the Annual Report of the Department of Mines for 1961. More complete and corrected information has since become available, and this report supersedes the previous summary).

This well was located at lat. 27°40′30″ S., long. 143°11′45″ E., 2½ miles east from Smart Oil Orient No. 1 and 50 miles west-north-west from Thargomindah. It was situated on the seismically-delineated Chesson Anticline, and was designed to test the Mesozoic and Palaeozoic sections for hydrocarbons, and also as a stratigraphic test for the Palaeozoic section. The drilling contractor was J. R. Robinson, using a Hydromaster 1880 percussion plant. Drilling floor elevation was 477 ft., and ground elevation 473 ft. Drilling commenced on 7th August, 1961, and total depth of 3,535 ft. was reached on 16th August, 1962. The work was subsidized by the Commonwealth Government.

Hole size was 15 in. from surface to 120 ft., 9½ in. from 120 ft. to 1,500 ft., 7½ in. from 1,500 ft. to 3,200 ft. and 6 in. from 3,200 ft. to total depth. Ten and three-quarter-inch 51-lb. casing was set to 120 ft. and cemented to surface. Eight-inch 23-lb. casing was set to 1,500 ft. and cemented to 1,200 ft. Six-inch 11·6-lb. casing was set to 3,200 ft. and cemented to 2,300 ft. Twelve percussion cores were taken between 500 ft. and 3,500 ft. No electric logs were run.

The company has divided the section stratigraphically as follows:—

Surface–200 ft.	Winton Formation
200–1,450 ft.	Tambo Formation
1,450–2,270 ft.	Roma Formation
2,270–3,350 ft.	Blythesdale Group
3,350–3,535 ft.	Pre-Mesozoic ? sandstone and greywacke

Gas (mainly hydrogen) was reported from 1,315 ft. and wet gas from 2,353 ft. and 2,835 ft. Fluorescence was reported from a core at 2,400 ft. Salty water was encountered at 85 ft. and 185 ft., and fresh water at 1,185 ft., 2,353 ft., 2,383 ft., 2,515 ft., 2,595 ft., 2,655 ft. and 2,705 ft.

The well was plugged by cementing between 2,000-2,800 ft., 1,100-1,215 ft. and 0-120 ft. and abandoned as a dry hole on 24th August, 1962.

Standard Gas Cribb Island No. 1

Work on this well continued during 1962. Due to casing and cementing difficulties, the hole was not reamed and put into order until 28th July. Drilling then recommenced, and the contractors, Godfrey Bros., deepened the hole with the Hydromaster 750 plant to 2,151 ft. 9 in., penetrating mudstone and a sedimentary breccia composed of fragments of the Brisbane Metamorphics. Drilling was suspended on 7th November.

A new drilling contractor, J. R. Robinson, took over on 30th November, and deepened the hole with a Hydromaster 1880 percussion plant to 2,449½ ft. by 31st December. Sedimentary breccia was still being penetrated.

Drilling is continuing.

Standard Gas Boondall Scout No. 1

This well was located at the corner of Stansworth Road and Aberdeen Avenue, Boondall, a suburb about 9 miles north of Brisbane. The site was selected by divination. The driller was S. H. Scells, using a small percussion water-boring plant. Ground elevation was less than 25 ft. The well was spudded on 14th February, 1962, and completed at total depth of 1,014 ft. on 13th July, 1962. Eight-inch casing was seated at 34 ft., 6 in. at 364 ft. and 5 in. at 670 ft. The casing was later withdrawn.

Sludge samples were examined at the Geological Survey of Queensland and the following tentative lithologic and stratigraphic subdivision made—

0– 13 ft.	Soil and clay
13– 253 ft.	South Pine Formation (Tertiary) 13–251 ft. Mudstone 251–253 ft. Dolomitic limestone
253– 567 ft.	Basalt and decomposed basalt (Teritary)
567–1,014 ft.	Ipswich Coal Measure equivalents (Mesozoic) 567-602 ft. Shale 602–1,014 ft. Sandstone

Salt water was encountered at 21 ft. and at 96 ft. brackish water at 429 ft. and good flows of fresh water at 602 ft. and 967 ft. The driller reported gas bubbling at 253 ft. and 567 ft., the upper and lower limits, respectively, of the basalt. An oily film on the bore drain was reported between 784 ft. and 835 ft. This was found to be due to finely divided carbonaceous material.

Standard Gas Cribb Island Scout No. 11

This well was situated at Cribb Island, about 10 miles north-east from Brisbane. It was located 100 ft. on magnetic bearing 215° from Standard Gas Cribb Island Scout No. 9,

and was drilled to test for a showing of oil and gas met in Jackson's Bore. The driller was S. H. Scells, using a small percussion water-boring plant. Ground elevation was a few feet above high water mark. Drilling commenced on 5th August, 1962, and was completed at 220 ft. on 24th August, 1962.

The strata penetrated were reported as—

0– 90 ft.	Soil, mud and clay
90–120 ft.	Silt and fine sand
120–134 ft.	Sand and gravel
134–220 ft.	Basalt and decomposed basalt

The section appears to represent unconsolidated Quaternary sediments overlying Tertiary basalt.

Salty water was reported between 90 ft. and 134 ft. and at 141 ft. There were no indications of oil or gas.

Union-Kern-A.O.G. Moonie No. 1

This well was drilled to a depth of 6,106 ft. during 1961, after which the well was cemented, the casing jet perforated and tubing and the Christmas Tree installed. (The details of U.K.A. Moonie No. 1 were reported in the Annual Report of the Department of Mines for 1961.)

During the early part of 1962, production testing of the well was conducted. Cumulative production for this period of testing was 6,423 barrels of oil. Production during the last 24 hours was 523 barrels/day oil (45° API) and 97 mcf. gas in 20.2 hours.

The well was shut in and suspended as an oil and gas producer on 19th February, 1962.

Union-Kern-A.O.G. Wandoan No. 1

This well was located at lat. 26°10′30″ S., long. 149°54′00″ E., about 5 miles south-west from Wandoan. The well was designed as a test of the Lower Bundamba Formation on the seismically-determined Wandoan Anticline, and as a stratigraphic test of the underlying Permian rocks. The drilling contractor was Oil Drilling and Exploration Ltd., using a National Ideal 80B rig. Ground elevation was 958 ft., and kelly bushing elevation (level datum) was 977 ft. The well was spudded on 22nd April, 1962, and reached total depth of 10,736 ft. on 18th June, 1962. The work was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled to 29 ft., and 20-in. 52-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was then drilled and reamed to 1,045 ft., and 13⅜-in. 48-lb. casing was set to 1,036 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 1,045 ft. to 2,025 ft., and 9⅞-in. hole from 2,025 ft. to total depth.

Twenty-five conventional cores were cut between 1,015 ft. and 10,716 ft., coring in all 182 ft. with 52 per cent. recovery. Schlumberger took 25 sidewall cores between 1,920 ft. and 10,567 ft. Electric logs were run by Schlumberger between 1,035-10,736 ft., micrologs between 1,700-10,736 ft. and sonic logs between 1,036-10,730 ft. A velocity survey was run between 1,755-10,730 ft. Deviation surveys were run and a gas-detection unit was maintained.

The company reported the stratigraphic section to be—

0– 1,753	ft.	Walloon Formation
1,753– 3,530	ft.	Bundamba Formation
		1,753–2,618 ft. Upper Member
		2,618–3,159 ft. Middle Member
		3,159–3,530 ft. Lower Member
3,530– 4,817	ft.	Wandoan Formation
4,817– 9,285	ft	Cabawin Formation
9,285–10,736+	ft.	Kianga Formation

The Wandoan Formation has been defined by Union Oil Development Corporation to include 1,287 ft. of tuffaceous quartzose sandstone, carbonaceous shale, and siltstone penetrated between 3,530–4,817 ft. in this well. The formation lies conformably below the Bundamba Formation and disconformably above the Cabawin Formation.

Petroleum indications were noted in several places. Bluish-yellow-white fluorescence and carbon tetrachloride cut were noted in the Lower Bundamba Formation below 3,050 ft., and traces of hydrocarbons were detected in the formation water from this level. Blue and white fluorescence were noted in the upper part of the Wandoan Formation, and bluish-yellow-white fluorescence in sandstones in the upper part of the Cabawin and Kianga Formations. Two Halliburton Formation Tests were conducted, and the results are summarized as—

H.F.T. No. 1 (3,260–3,278 ft.)	Recovered fresh water
H.F.T. No. 2 (6,024–6,095 ft.)	Recovered gassy, watery mud.

Cement plugs were set between 4,835-4,935 ft., 2,840-2,990 ft., 1,570-1,720 ft., 970-1,056 ft. and 22-40 ft., and the well abandoned as a dry hole on 21st June, 1962.

Union-Kern-A.O.G. Middle Creek No. 1

This well was located at lat. 27°38′45″ S., long. 150°18′35″ E., about 27 miles south-south-west from Tara, and about 8 miles north-north-east from Union-Kern-A.O.G. Moonie No. 1. The drilling was designed as a test of the Lower Bundamba sandstones to the north-east of Moonie where favourable conditions for onlap and wedging of the Bundamba onto pre-Bundamba rocks were expected to be present and to provide stratigraphic traps.

The drilling contractor was Mines Administration Pty. Ltd., and the drilling rig a National "Ideal" 55. Drilling commenced on 19th May, 1962, and reached total depth of 6,126 ft. on 8th June, 1962. Ground elevation was 901 ft., and the kelly bushing elevation (the datum level) was 913 ft. The work was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled to 23 ft., and 20-in. 52-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was then drilled and reamed to 514 ft., and 13⅜-in. 48-lb. casing was set to 507 ft., and cemented to surface. Twelve and one-quarter-inch hole was drilled from 514 ft. to 1,141 ft., and 8¾-in. hole from 1,141 ft. to total depth.

Ten conventional cores were taken between 4,687 ft. and 6,126 ft., coring 115 ft. with 95·3 ft. (or 83 per cent.) recovery. Schlumberger ran electric logs between 508-6,124 ft., micro-logs between 4,500-6,124 ft., laterolog between 4,300-6,121 ft. and a sonic log between 508-6,100 ft. A continuous dip-meter survey was run between 4,200-6,114 ft. and a velocity survey between 650-6,120 ft. Deviation surveys were run, and a gas-detection unit maintained.

The stratigraphic section penetrated was reported to be—

0- 130 ft.	Tertiary-Quaternary rocks.
130-2,283 ft.	Roma Formation.
2,283-3,336 ft.	Blythesdale Formation.
3,336-4,381 ft.	Walloon Formation.
4,381-5,912 ft.	Bundamba Formation.
	4,381–5,020 ft. Upper Member
	5,020–5,560 ft. Middle Member
	5,560–5,912 ft. Lower Member
5,912-6,126 ft.	Kuttung Formation.

The only evidences of gas and oil occurrence were a high ethane reading on the gas detector over the interval 5,175-5,420 ft., and the presence of bluish-white fluorescence between 5,210-5,250 ft., 5,587-5,590 ft. and 5,750-5,755 ft. These indications were in the Bundamba Formation. However, the gas reading is believed to be due to a fault in the recording instrument. The primary target zone, the Lower Bundamba sandstones, proved to be wet. Three Halliburton Formation Tests were conducted. The results are summarized below:

H.F.T. No. 1 (5,191-5,263 ft.)	Tool failure
H.F.T. No. 2 (5,189-5,263 ft.)	Tool failure
H.F.T. No. 3 (5,240-5,263 ft)	Recovered fresh water

Cement plugs were set between 5,135-5,304 ft., 3,961-4,130 ft., 1,970-2,185 ft., 486-525 ft. and 17-32 ft. and the well was abandoned on 10th June, 1962.

Union-Kern-A.O.G. Burunga No. 1

This well was located at lat. 26°00′ S., long. 150°04′ 43″ E., about 12 miles north-east from Wandoan, and 16 miles north-east from U.K.A. Wandoan No. 1. It was drilled as a test of the Lower Bundamba Formation on the seismically-determined Burunga Structure (one of the largest recognized so far in the Surat Basin) and to evaluate petroleum possibilities of the underlying Permian formations.

The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig a National 80B. Ground elevation was 1,074 ft., and kelly bushing elevation 1,091.5 ft. The well was spudded on 6th July, 1962, and total depth of 10,242 ft. was reached on 28th September, 1962. The work was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled from surface to 30 ft. and 20-in. 52-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-in hole was drilled from 30 ft. to 1,019 ft., when 13⅜-in. 48-lb. casing was set to 1,008 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 1,019 ft. to 2,310 ft., and 9⅝-in. 36-lb. casing was set to 2,300 ft. and cemented to 800 ft. Nine and seven-eighths-inch hole was drilled from 2,310 ft. to 2,386 ft., and 8¾-in. hole from 2,386 ft. to total depth.

Twenty-five conventional cores were cut, coring 243 ft. Twenty-four cores, totalling 207½ ft., were recovered (85·4 per cent. recovery). Schlumberger took 21 sidewall cores between 3,986 ft. and 4,154 ft. Schlumberger ran an electric log between 100 ft. and 10,230 ft., a microlog between 1,009 ft. and 10,227 ft., a sonic log between 1,009 ft. and 10,220 ft., and a caliper log. A velocity survey was run between 2,310 ft. and 10,231 ft., deviation surveys were conducted and a continuous gas-detection unit was maintained.

The following stratigraphic succession was reported:—

Surface–	296 ft.	Walloon Formation
296–	2,030 ft.	Bundamba Formation
		296–1,058 ft. Upper Member
		1,058–1,598 ft. Middle Member
		1,598–2,030 ft. Lower Member
2,030–	2,083 ft.	Wandoan Formation
2,083–	4,657 ft.	Kianga Formation
4,657–	9,801 ft.	Back Creek Formation
9,801–10,242 ft.		Cracow Formation

There were a number of hydrocarbon indications. Bluish-yellowish-white fluorescence was noted in the Lower Bundamba Formation. Methane shows occurred in the Kianga Formation, associated with coal seams, and traces of blue to yellowish-white fluorescence were logged in sandstones of this formation. A tuff core at 4,179 ft. was bleeding gas and showed traces of oil on fractures. Traces of white to bluish-white fluorescence were recorded in the Back Creek Formation and strong gas shows were recorded between 7,480 ft. and 8,015 ft. Methane was recorded from the upper weathered and fractured part of the Cracow Formation.

Six open hole formation tests were conducted. The results are summarized below—

H.F.T. No. 1 (1,757– 1,792 ft.)	Recovered fresh water
H.F.T. No. 2 (4,106– 4,214 ft.)	Recovered watery mud and gassy water
H.F.T. No. 3 (7,889– 7,911 ft.)	Recovered gas (250 mcfd.)
H.F.T. No. 4 (10,065–10,242 ft.)	Recovered gas-cut mud
H.F.T. No. 5 (10,077–10,242 ft.)	Recovered gas-cut mud
H.F.T. No. 6 (3,998– 4,070 ft.)	Recovered mud and watery mud

Cement plugs were set between 8,430–8,581 ft., 6,350–6,495 ft., 4,020–4,202 ft., 3,560–3,710 ft., 2,230–2,323 ft., 340–390 ft. and 22–40 ft. and the hole was abandoned on 6th October, 1962.

Union-Kern-A.O.G. Yarrill Creek No. 1

This well was located at lat. 28°04′42″ S., long. 150°25′16″ E., 32 miles north-north-east from Goondiwindi, and 25 miles south-east of the Moonie area. The drilling was designed as a test of the petroleum possibilities of the Lower Bundamba Formation in a domal closure determined by seismic work. The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig an Ideco Hydrair Junior Super 7–11. Kelly bushing elevation was 921 ft. and ground elevation 908 ft. Drilling commenced on 23rd September, 1962, and was completed at total depth of 4,545 ft. on 9th October, 1963. The work was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled from surface to 25 ft., and 20-in. 52-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was drilled from 25 ft. to 618 ft., and 13⅜-in. 48-lb. casing was set to 609 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 618 ft. to 648 ft., 9⅞-in. hole from 648 ft. to 4,395 ft., and 8¾-in. hole from 4,395 ft. to 4,545 ft.

Eight conventional cores were cut between 1,094 ft. and 4,545 ft., coring a total of 43 ft., and recovering a total of 36 ft. (or 83·7 per cent.). Nineteen sidewall cores were taken by Schlumberger between 2,672 ft. and 3,568 ft. Schlumberger ran logs over the following intervals:—

Electric Logs	609–4,545 ft.
Microlog	2,000–4,545 ft.
Sonic Log	609–4,535 ft.
Gamma Ray-Neutron Log ..	609–4,544 ft.

Deviation surveys and a velocity survey were run, and a drilling rate log and gas log kept.

The stratigraphic section was reported to be—

Surface–1,156 ft.	Roma Formation
1,156–2,088 ft.	Blythesdale Formation
2,088–2,720 ft.	Walloon Formation
2,720–3,680 ft.	Bundamba Formation
	2,720–3,375 ft. Upper Member
	3,375–3,680 ft. Lower Member
3,680–4,545 ft.	Kuttung Formation

No indications of hydrocarbons were encountered. One Halliburton formation test was conducted, the result being summarized below:—

H.F.T. No. 1 (3,521–3,621 ft.) Recovered fresh water

Cement plugs were set between 3,621–3,704 ft., 2,383–2,533 ft., and 1,550–1,656 ft. and abandoned on 13th October, 1962. The upper section was converted to a water well, producing from the Blythesdale Formation.

Union-Kern-A.O.G. Minima No. 1

This well was located at lat. 28°21′33″ S., long. 150°06′54″ E., 18 miles north-west from Goondiwindi, and 40 miles south of the Moonie area. The drilling was designed as a test of the petroleum possibilities of the Lower Bundamba Formation on a seismically determined closed structure. The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig an Ideco Hydrair Junior Super 7–11. Kelly bushing elevation was 691 ft., and ground elevation 680 ft. Drilling commenced on 18th October, 1962, and reached total depth of 7,142 ft. on 9th November, 1962. The work was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled from surface to 20 ft., and 20-in. 52-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was drilled from 20 ft. to 790 ft., and 13⅜-in. 48-lb. casing was set to 779 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 790 ft. to 891 ft., 9⅞-in. hole from 891 ft. to 7,132 ft. and 8¾-in. hole from 7,132 ft. to 7,142 ft.

Seven conventional cores were cut between 4,773 ft. and 7,142 ft., coring 56 ft. for a recovery of 43 ft. 3 in. (or 77 per cent.). Thirteen sidewall cores were recovered between 5,503 ft. and 7,064 ft. Schlumberger ran electric logs between 779–7,132 ft., a microlog between 4,500–7,132 ft., a sonic log between 779–7,120 ft. and a continuous dipmeter between 779–7,132 ft.

Deviation surveys and a velocity survey were conducted. A drilling rate log and a gas log were kept.

The company reported the stratigraphic succession to be—

Surface–2,893 ft.	Roma Formation
2,893–3,976 ft.	Blythesdale Formation
3,976–4,577 ft.	Walloon Formation
4,577–5,695 ft.	Bundamba Formation
	4,577–5,115 ft. Upper Member
	5,115–5,399 ft. Middle Member
	5,399–5,695 ft. Lower Member
5,695–6,153 ft.	Cabawin Formation
6,153–6,264 ft.	Kianga Formation
6,264–6,782 ft.	Back Creek Formation
6,782–7,142 ft.	Kuttung Formation

The only indications of petroleum recorded were whitish-yellow fluorescence and traces of carbon tetrachloride cut in the Lower Bundamba Formation. Two open-hole formation tests were conducted. The results are summarized below—

H.F.T. No. 1 (5,403–5,418 ft.)	Recovered fresh water
H.F.T. No. 2 (5,544–5,560 ft.)	Recovered fresh water

The well was plugged by setting cement plugs between 6,300–6,450 ft., 5,560–5,700 ft., 4,050–4,200 ft., 2,650–2,800 ft., 715–785 ft. and 17–32 ft., and abandoned on 12th November, 1962.

Union-Kern-A.O.G. Cockatoo Creek No. 1

This well was located at lat. 25°34′22″ S., long. 150°06′15″ E., 23 miles east-north-east from Taroom. Drilling was designed as a test of the seismically-mapped Cockatoo Creek Anticline, a major Permian closure paralleling the eastern hinge line of the Bowen Basin. The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig a National 80B. Kelly bushing elevation was 673½ ft., and ground elevation 656 ft. Drilling commenced on 13th November, 1962, and had reached a depth of 7,555 ft. on 31st December, 1962.

Drilling is continuing.

Union-Kern-A.O.G. Tara No. 1

This well was located at lat. 27°20′50″ S., long. 150°29′26″ E., about 5 miles south-east from Tara, and 30 miles north-east from the Moonie area. The well was drilled to test the Lower Bundamba Sandstone in a domal closure unconformably overlying a Permian section. The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig an Ideco Hydrair Junior Super 7-11. Kelly bushing elevation was 1,057 ft., and ground elevation 1,043 ft. Drilling commenced on 18th November, 1962, and total depth of 6,795 ft. was reached on 15th December, 1962. The drilling was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled from surface to 25 ft., and 20-in. 52-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was drilled from 25 ft. to 620 ft., and 13⅜-in. 48-lb. casing was set to 609 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 620 ft. to 650 ft., and 9⅞-in. hole from 650 ft. to total depth.

Fourteen conventional cores were cut between 3,511 ft. and 6,795 ft., coring 78 ft. with 63½ ft. (or 82 per cent.) recovery. Schlumberger ran electric logs between 609 ft. and 6,788 ft., a microlog between 3,600 ft. and 6,788 ft., a sonic log between 609 ft. and 6,775 ft. and a neutron log between 300 ft. and 6,790 ft. Deviation surveys and a velocity survey were run. A continuous gas-detection unit was maintained.

The stratigraphic succession was reported to be—

Surface–1,577 ft.	Roma Formation
1,577–2,692 ft.	Blythesdale Formation
2,692–3,950 ft.	Walloon Formation
3,950–5,378 ft.	Bundamba Formation
	3,950–4,605 ft. Upper Member
	4,605–5,155 ft. Middle Member
	5,155–5,378 ft. Lower Member
5,378–6,745 ft.	Back Creek Formation
6,745–6,795 ft.	Kuttung Formation

Fluorescence was noted in the Walloon, Upper Bundamba, and Middle Bundamba Formations. No formation tests were conducted.

Cement plugs were set between 5,900–6,050 ft., 2,900–3,050 ft., 1,450–1,600 ft., 565–609 ft. and 17–32 ft. The well was abandoned on 17th December, 1962.

Union-Kern-A.O.G. Crowder No. 1

This well was located at lat. 27°52′36″ S., long. 150°15′34″ E., 43 miles south-south-west from Tara, and 6 miles south-east of Union-Kern-A.O.G. Moonie No. 9. Drilling was designed to test the Lower Bundamba Formation for petroleum accumulation in a seismically-determined north-west plunging anticlinal structure. The drilling contractor was Oil Drilling and Exploration Ltd., and the drilling rig an Ideco Hydrair Junior Super 7-11. Kelly bushing elevation was 868 ft., and ground elevation 855 ft. Drilling commenced on 22nd December, 1962, and reached total depth of 5,864 ft. on 6th January, 1963. The work was subsidized by the Commonwealth Government.

Thirty-inch hole was drilled from surface to 25 ft., and 20-in. 52-lb. conductor pipe was set to that depth and cemented to surface. Seventeen and one-half-inch hole was drilled from 25 ft. to 612 ft., and 13⅜-in. 48-lb. casing was set to 596 ft. and cemented to surface. Twelve and one-quarter-inch hole was drilled from 612 ft. to 615 ft., and 9⅞-in. hole from 615 ft. to total depth.

Four conventional cores were cut between 4,460 ft. and 5,815½ ft., coring a total of 38½ ft. and recovering 38¼ ft. (or 99.4 per cent). Seventeen sidewall cores were recovered between 4,902 ft. and 5,614 ft. Schlumberger ran logs over the following intervals—

Electric Log	596–5,865 ft.
Induction—Electric Log	4,000–5,864 ft.
Microlog	4,300–5,865 ft.
Sonic Log	596–5,855 ft.
Laterolog	4,000–5,862 ft.
Continuous Dipmeter	596–5,859 ft.

Deviation surveys and a velocity survey were run and drilling-rate and gas logs kept.

The company reported the stratigraphic succession as—

Surface–1,346 ft.	Roma Formation
1,346–3,430 ft.	Blythesdale Formation
3,430–4,323 ft.	Walloon Formation
4,323–5,620 ft.	Bundamba Formation
	4,323–4,850 ft. Upper Member
	4,850–5,385 ft. Middle Member
	5,385–5,620 ft. Lower Member
5,620–5,864 ft	Kuttung Formation

Fluorescence and cut were noted in the Middle and Lower Bundamba Formations. One Halliburton formation test was conducted, the results being summarized as—

H.F.T. No. 1 5,388–5,434 ft.	Recovered gassy fresh water

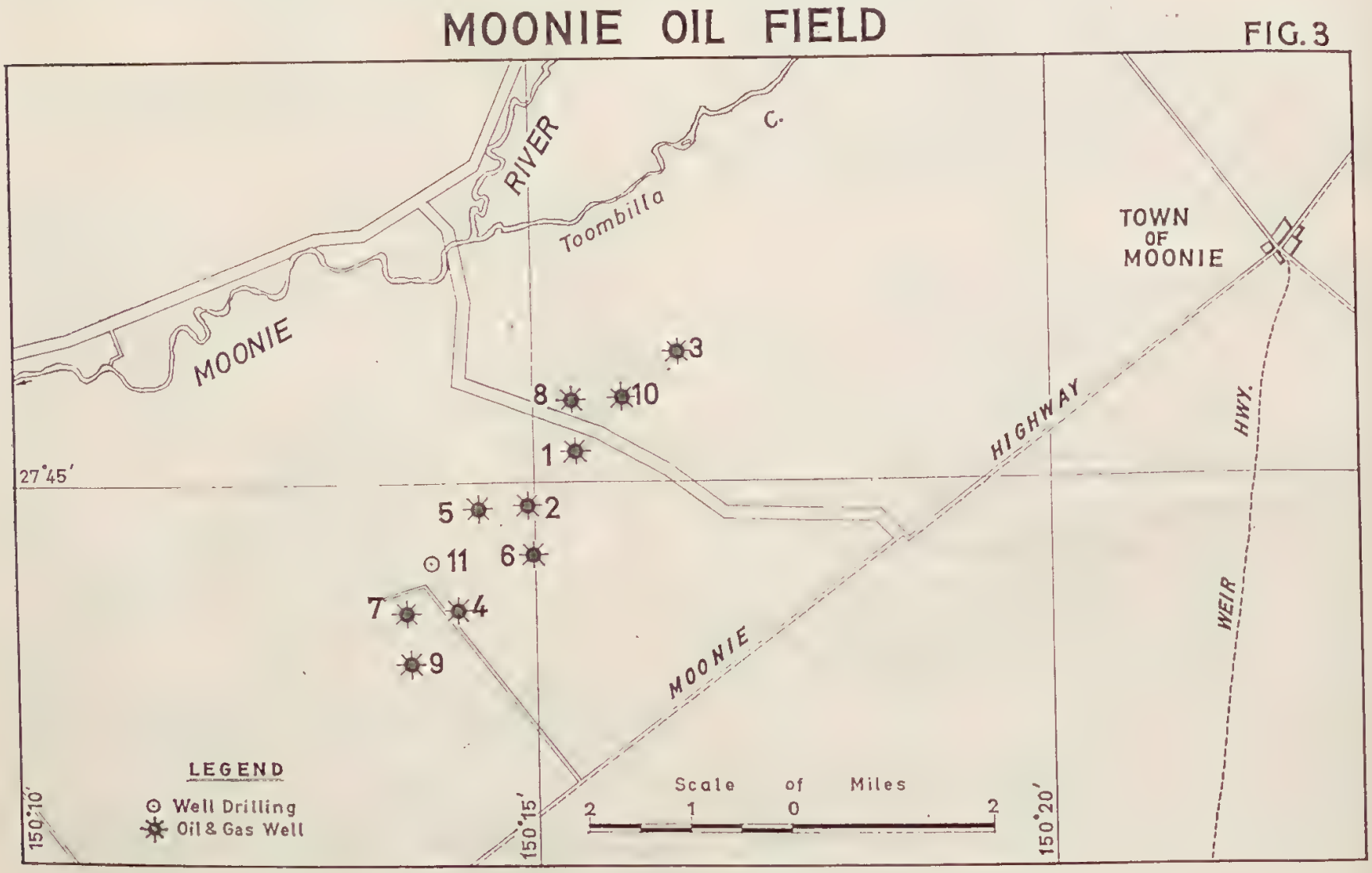
Cement plugs were set between 5,434–5,500 ft., 5,206–5,355 ft., 3,550–3,700 ft. and 2,650–2,800 ft., and the well abandoned on 17th January, 1963. The upper part of the hole was converted to a water well producing from the Blythesdale Formation.

DEVELOPMENT DRILLING 1962

Development drilling of the Moonie Oil Field was begun early in 1962. Nine holes, all producers, were completed during the year, and a tenth, Moonie No. 11, was drilling ahead at 5,347 ft. on 31st December, 1962. The producing formation is the Precipice Sandstone (Jurassic), previously "lower Bundamba." The main zone, at about 5,800 ft., produced up to 1,700 BOPD 44-45° API and 320 MCFD gas on ½ inch choke. A second zone at about 5,650 ft., productive only in Moonie No. 2, tested 660 BOPD 49° API and 94 MCFD gas on 20/64-inch choke. All production figures quoted here are drawn from published sources but should be regarded as preliminary only (refer Part 6).

No.	Location lat. S. long. E.	Elevation	Total Depth	Initial Production			
				Zone	Choke	Oil BOPD	Gas MCFD
			Feet		Inch		
2	27°45′15″ 150°14′55″	892 KB 874 GL	6,289	upper lower	20/64 $\frac{5}{8}$	660 1390	94 240
3	27°43′54″ 150°16′22″	896 KB 870 GL	6,021	lower	5/16	620	96
4	27°46′15″ 150°14′18″	883 KB 871 GL	6,005	lower	½	1320	200
5	27°45′21″ 150°14′30″	887 KB 874 GL	5,990	lower	½	1700	320
6	27°45′46″ 150°15′03″	886 KB 875 GL	6,502	lower	½	720	60
7	27°46′18″ 150°13′45″	883 KB 875 GL	5,953	lower	½	1135	190
8	27°44′26″ 149°15′21″	890 KB 877 GL	6,031	lower	none	205	..
9	27°46′45″ 150°13′52″	880 KB 875 GL	5,942	lower	½	840	100
10	27°44′26″ 150°15′47″	893 KB 880 GL	5,970	lower	½	1000	100
11	27°45′50″ 150°14′04″	869 KB 857 GL	..	..	..	..	..

Figure 3 shows the situation of Moonie development wells drilled to 31st December, 1962



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QUEENSLAND
DEPARTMENT OF MINES

Fourth Supplement to
Geological Survey Publication No. 299
"OCCURRENCE OF PETROLEUM AND NATURAL GAS IN QUEENSLAND"
1961

PETROLEUM EXPLORATION IN QUEENSLAND DURING 1963

BRISBANE
By Authority: S. G. REID, Government Printer
1964

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PREFACE

Publication No. 299 of the Geological Survey of Queensland—"Occurrence of Petroleum and Natural Gas in Queensland"—dealt with the search for petroleum in Queensland to the end of 1959. To keep this publication up to date, it was decided to issue as a supplement each year, a reprint of the section of the Annual Report of the Department of Mines relating to petroleum exploration. This reprint is the fourth supplement.

Due to increased drilling activity during 1963, there was a much greater volume of information to be reported. It was therefore decided to report in a summarised form, listing the more important information, rather than in the more detailed presentation of previous years.

The supplement was prepared by officers of the State Mining Engineer's Branch and of the Petroleum Section, Geological Survey of Queensland. Final arrangement was by I. G. Sanker.

The Bechtel Pacific Corporation's Moonie Camp in mid-June, 1963. Work on the early stages of the pipeline was directed from this location. One of the completed Moonie Wells is circled in the background.

The tanker Oscar Gorthon loads the first shipment Moonie crude at the new Union-Kern-A.O.G. Lytton terminal.

PETROLEUM PROSPECTING

Part 1—Prospecting
Part 2—Drilling
Part 3—Employment and Accidents
Part 4—Legislation
Part 5—General Survey of the Industry

PART 1—PROSPECTING

Figure 1 shows the location of petroleum prospecting titles as at 31st December, 1963. These total 36 and comprise 34 Authorities to Prospect and two Prospecting Petroleum Permits. The total area held under title at the above date was 728,886 square miles, being 728,586 square miles held under Authorities to Prospect and 300 square miles under Prospecting Petroleum Permits.

The number of Authorities to Prospect held on 31st December, 1963, shows an increase of one over the figure for 31st December, 1962, and the number of Prospecting Petroleum Permits decreased from 5 to 2.

A number of compulsory surrenders of areas took place during the year and applications for Authorities to Prospect over these areas, under set conditions which were widely advertised, were invited as from 1st January, 1964. Most of the vacant areas are devoid of prospects, and it is not expected that a great deal of interest will be displayed.

Table A lists titles which have been surrendered and re-issued during the year, and Table B comprises a tabulation of titleholders and operators as at 31st December, 1963, and a summary of field operations and of wells drilled during the year for each titleholder.

Table A

Title No.	Holder	Locality	Remarks
P.P.P. 704	Standard Gas Pty. Ltd.	Brisbane	Expired—re-issued as P.P.P. 715
P.P.P. 710	Planet Exploration Company Pty. Ltd.	South of Rolleston	Surrendered and re-issued as A. to P. 100P
P.P.P. 711	Planet Exploration Company Pty. Ltd.	South of Rolleston	
P.P.P. 712	Planet Exploration Company Pty. Ltd.	South of Rolleston	
78P	Nortex Australian Oils Ltd.	Monto	Surrendered. Southern half re-issued as 97P
85P	L. H. Smart Exploration Co. Ltd.	Eromanga	Surrendered. Re-issued as 98P and 99P

The new Moonie Field installation by night with the main storage tank in the background

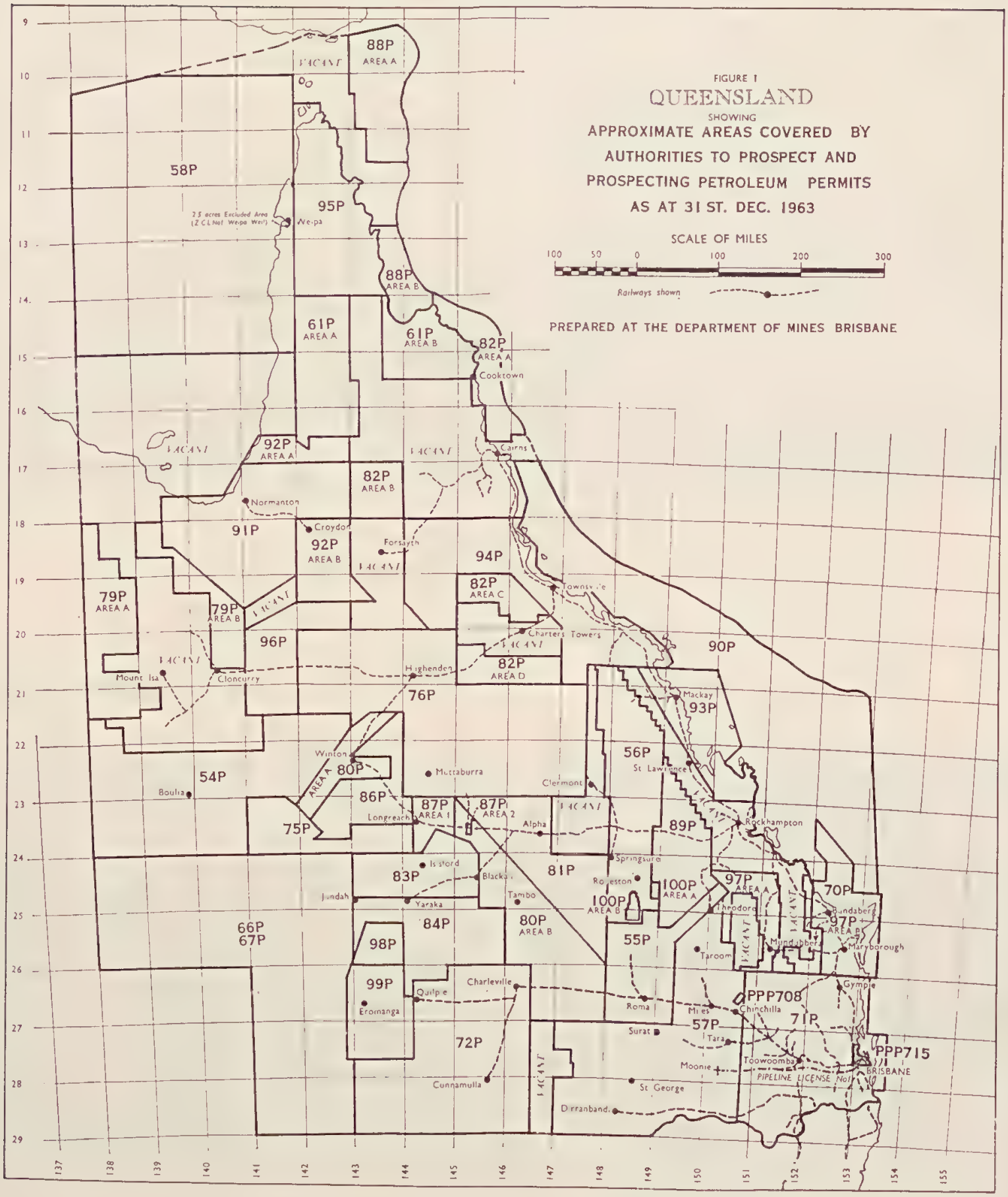


FIGURE 1
QUEENSLAND
SHOWING
APPROXIMATE AREAS COVERED BY
AUTHORITIES TO PROSPECT AND
PROSPECTING PETROLEUM PERMITS
AS AT 31 ST. DEC. 1963
SCALE OF MILES
100 50 0 100 200 300
Railways shown
PREPARED AT THE DEPARTMENT OF MINES BRISBANE
88P AREA A
VACANT
58P
95P
25 acres Excluded Area (Z C L Nol Weipa Well)
Weipa
88P AREA B
61P AREA A
61P AREA B
82P AREA A
Cooktown
92P AREA A
Cairns
82P AREA B
Normanton
91P
Croydon
92P AREA B
Forsayth
94P
82P AREA C
79P AREA A
79P AREA B
Townsville
96P
Charters Towers
82P AREA D
90P
Mount Isa
Cloncurry
Highenden
76P
Mackay
93P
Winton
80P AREA A
Muttaburra
56P
St Lawrence
54P
Boulia
86P
87P AREA 1
87P AREA 2
Clermont
75P
Longreach
Alpha
89P
Rockhampton
Springsure
Isisford
83P
Blackall
81P
Roseston
100P AREA A
97P AREA A
70P
Jundah
Yaraka
Tambo
100P AREA B
Theodore
Bundaberg
97P AREA B
66P
67P
84P
80P AREA B
55P
Mundubbera
Maryborough
98P
Taroom
99P
Charleville
Quilpie
Eromanga
Roma
Gympie
PPP708
Miles
Chinchilla
71P
57P
Surat
Tara
72P
Toowoomba
PPP715
Moonie
BRISBANE
PIPELINE LICENSE No1
Cunnamulla
St George
Dirranband
137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

Table B

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1963

Authorities to Prospect Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
Alliance Oil Development Australia N.L., H. B. Borwick, Managing Director 11th Floor, 100 Collins Street, Melbourne; L. W. Doggett, Agent, Box 281D, G.P.O., Brisbane	Oil Development N.L. (Reading and Bates (Aust.) Pty. Ltd.)	81P	14,610	Alpha ..	Photogeology Gravity .. Reflection Refraction	7 3 7	Oil Development Maranda No. 1	25 miles NNE. of Barcaldine	Nil	6,491	Plugged as a dry hole	Alliance Petroleum Australia N.L. have 25% interest in 81P. In south-east of the Title an operating Agreement is in force with Planet Exploration Company Ltd., Managing Director J. G. Fuller, 26 O'Connell Street, Sydney
Amalgamated Petroleum Exploration Pty. Ltd., A. R. Dodson, Executive Director, Box 4721, G.P.O., Melbourne Dr. T. B. Haites, Exploration Manager, Scottish Union House, 127 Eagle Street, Brisbane	Titleholder (Forasol, S.A.)	79P Area A	12,700	Mount Isa	None		Amalgamated Petroleum Morstone No. 1	35 miles NE. of Camooweal	2,504	2,504	Plugged as a dry hole	..
	..	79P Area B	7,300	Cloncurry	None		No Drilling Activity					..
	Titleholder (Drilling Contractors (Aust.) Pty. Ltd.)	97P Area A	4,580	Monto ..	Geological Reflection	0·5 1·0	Amalgamated Petroleum Abercorn No. 1	12 miles SE. of Mulgildie	8,855	8,855	Plugged as a dry hole	..
							Amalgamated Petroleum Mulgildie No. 1	½ mile SSE. of Mulgildie	4,013	4,013	Plugged as a dry hole	..
		97P Area B	2,100	Biggenden	None		No Drilling Activity					..
Amerada Petroleum Corporation of Australia Ltd., Continental Oil Company of Australia Ltd., Marathon Petroleum Australia Ltd. (Equal Shares)	Marathon Petroleum Australia, E. B. Shade, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. R. Loose, Exploration Manager, Box 687K, G.P.O., Brisbane	75P	8,300	West of Longreach	Reflection	3·5	No Drilling Activity					..
		83P	9,300	Isisford	Reflection	1·5	No Drilling Activity					..
Ampol Exploration (Q'land) Pty. Ltd., W. G. Walkley, Managing Director S. Nasr, Exploration Manager, Buchanan Street, Balmain, N.S.W.	Titleholder	93P	11,770	Mackay	Geological Aeromagnetic	12 3·5	No Drilling Activity					..
	..	94P	26,050	Ingham–Bowen	Geological Aeromagnetic Reflection Refraction	12 2 3·5 0·3	No Drilling Activity					..
Associated Australian Oilfields N.L., E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane	Eastern part of Title Petroleum Exploration Co. (Petexco) in association with Mines Administration Pty. Ltd., E. N. Avery and D. M. Traves; Western part of Title Australian Aquitaine Petroleum Pty. Ltd., G. Rutman, Director General S.N.P.A., Box 82, Pau, France	86P	9,300	West of Longreach	Magnetometric Reflection	3⅓ 3⅓	No Drilling Activity					In areas 86P, 55P, 56P and 54P, Associated Australian Oilfields N.L., Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Company Ltd., Associated Continental Petroleum N.L., Interstate Oil Ltd. and Sleigh Exploration No Liability are jointly associated

Table B—continued

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1963—continued

Authorities to Prospect Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
Associated Australian Oilfields N.L., and Associated Freney Oilfields N.L., E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane	Petroleum Exploration Co. (Petexco) in association with Mines Administration Pty. Ltd., E. N. Avery, and D. M. Traves (Richter Bawden Drilling Pty. Ltd.	55P	11,570	Roma–Theodore	Reflection	10·5	A.A.O. Applegrove No. 1	8 miles SE. of Roma	4,144	4,144	Completed potential gas producer	..
							A.A.O. Arbroath No. 1	21 miles WSW. of Roma	8,367	8,367	Plugged as a dry hole	..
							A.A.O. Bardloming No. 1	17 miles SE. of Roma	4,695	4,695	Plugged as a dry hole	Trace of gas from tests
							A.A.O. Bony Creek No. 1	16 miles SE. of Roma	4,583	4,583	Completed as a potential gas producer	Discovery Well—Bony Creek Gas Field with test production of 2·35 Mmcf/day Gas
							A.A.O. Bony Creek No. 2	16 miles SE. of Roma	4,646	4,646	Completed as a potential gas producer	Tested 3·4 Mmcf/day Gas
							A.A.O. Bony Creek No. 3	16 miles SE. of Roma	4,632	4,632	Gas Show. Plugged as a dry hole	Tested 160 Mcf/day Gas prior to abandonment
							A.A.O. Bony Creek No. 4	16 miles SE. of Roma	4,500	4,500	Completed as a potential gas producer	Tested 2·53 Mmcf/day Gas
							A.A.O. Bony Creek No. 5	16 miles SE. of Roma	4,330	4,330	Completed as a potential gas producer	Tested 6·5 Mmcf/day Gas
							A.A.O. Bony Creek No. 6	16 miles SE. of Roma	4,510	4,510	Completed as a potential gas producer	Tested 5·42 Mmcf/day Gas
							A.A.O. Bony Creek No. 7	16 miles SE. of Roma	4,711	4,711	Testing	Test recoveries of water and mud
							A.A.O. Brucedale No. 1	25 miles SSE. of Roma	5,255	5,255	Plugged as a dry hole	..
							A.A.O. Ingle No. 1	5 miles SE. of Roma	4,202	4,202	Plugged as a dry hole	..
							A.A.O. Kildare No. 1	13 miles NW. of Injune	5,724	5,724	Plugged as a dry hole	Gas Shows
							A.A.O. Kildare No. 2	14 miles NW. of Injune	7,667	7,667	Plugged as a dry hole	Gas Shows
							A.A.O. Lorelle No. 1	36 miles ESE. of Roma	9,065	9,065	Plugged as a dry hole	Traces of gas and oil

							A.A.O. Lorne No. 1	24 miles WSW. of Roma	4,250	4,250	ugged as a dry hole	.
							A.A.O. Richmond No. 1	9 miles SE. of Roma	4,130	4,130	Completed as a potential oil producer	Discovery Well Richmond No. 1 pool. Tested 855 bbls/day 47° A.P.I.
							A.A.O. Richmond No. 2	9 miles SE. of Roma	4,201	4,201	Plugged as a dry hole	..
							A.A.O. Richmond No. 3	9 miles SE. of Roma	4,883	4,883	Plugged as a dry hole	..
							A.A.O. Richmond No. 4	9 miles SE. of Roma	4,400	4,400	Plugged as a dry hole	..
							A.A.O. Richmond No. 5	9 miles SE. of Roma	4,370	4,370	Completed as a potential oil/gas producer	Discovery Well Richmond Gas Field Tested oil with G.O.R. 2,000 cu.ft. per bbl
							A.A.O. Richmond No. 6	9 miles SE. of Roma	4,242	4,242	Plugged as a dry hole	..
							A.A.O. Richmond No. 7	9 miles SE. of Roma	4,200	4,200	Completed as a potential gas producer	Tested 6·0 Mmcf/day Gas
							A.A.O. Richmond No. 8	9 miles SE. of Roma	4,201	4,201	Completed as a potential gas producer	Tested 3·5 Mmcf/day Gas
							A.A.O. Richmond No. 9	9 miles SE. of Roma	425	..	Drilling	..
							A.A.O. Roma South No. 1	½ mile S. of Roma	3,854	3,854	Awaiting completion as a water well	Gas Shows
							A.A.O. Sunnybank No. 1	18 miles NE. of Surat	10	7,134	Suspended after inconclusive testing	Initial DST with oil recovery not sustained on later production testing
							A.A.O. Sunnybank No. 2	18 miles NE. of Surat	7,244	7,244	Plugged as a dry hole	Oil Shows
							A.A.O. Sunnybank No. 3	18 miles NE. of Surat	6,622	6,622	Plugged as a dry hole	Oil Shows
							A.A.O. Sunnybank No. 4	18 miles NE. of Surat	7,145	7,145	Plugged as a dry hole	Oil Shows
							A.A.O. Westgrove No. 3	20 miles NNW. of Injune	93	12,663	Plugged and Suspended	Awaiting completion as a Gas Producer
							A.A.O. Westgrove No. 4	20 miles NNW. of Injune	3,107	3,107	Plugged as a dry hole	..
		56P	18,057	Clermont–Mackay	Reflection	8	A.F.O. Bandanna No. 1	54 miles NNW. of Injune	4,041	4,041	Plugged as a dry hole	Gas Shows
							A.F.O. Inderi o. N1	25 miles ESE. of Springsure	5,433	5,433	Plugged as a dry hole	Gas Shows

Table B—continued

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1963—continued

Authorities to Prospect Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							A.F.O. Purbrook No. 1	15 miles SE. of Rolleston	4,949	4,949	Plugged as a dry hole	Oil Shows
							A.F.O. Rolleston No. 1	7 miles S. of Rolleston	7,837	..	Drilling	Gas Shows
	(Oil Drilling and Exploration Ltd.)	..	..	..	..	..	A.F.O. Rolleston No. 2	7 miles S. of Rolleston	3,683	..	Drilling	..
	(Austral Geoprospectors Pty. Ltd.)	..	..	..	..	..	A.F.O. Norwich Park Scout No. 1	For details see page 11				
Australian Aquitaine Petroleum Pty. Ltd. G. Rutman, Director General S.N.P.A., Box 82, Pau, France; J. Payan, Australian Manager, Box 142B, G.P.O., Brisbane	Titleholder	95P	17,900	Cape York Peninsula	Photogeology	0·25		No Drilling Activity				
Australian Oil Corporation, T. B. Lacaff, Jnr., General Manager, Midland Savings Building, Midland, Texas, U.S.A.; W. D. Mott, Consulting Geologist, Astor Court, corner Wharf and Leichhardt Streets, Brisbane	Titleholder	96P	10,035	Julia Creek	Geological and geochemical reconnaissance	..		No Drilling Activity				
Australian Oil and Gas Corporation Ltd., T. H. W. Dee, Managing Director, Box 5048, G.P.O., Sydney; T. H. Koch, Exploration Manager, Box 5048, G.P.O., Sydney	Titleholder	90P	57,000	Great Barrier Reef	Geological	0·25		No Drilling Activity				
Delhi Australian Petroleum Ltd. (50%) and Santos Limited (50%). Delhi: W. Clifford Smith, Vice President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837, G.P.O., Adelaide, S.A.; Santos: J. E. Klug, Chief Executive Officer, Bennet and Fisher Building, 12 Currie Street, Adelaide, S.A.	Delhi Australian Petroleum Corporation	58P	92,230	Gulf of Carpentaria	None			No Drilling Activity				
	Delhi Australian Petroleum Corporation (French Petroleum Company (Australia) Ltd. hold an option and are operators for an area in the far south-west of these Titles)	66P	33,800	Haddon Corner	Magnetometric	9	Delhi Santos Naryilco No. 1	200 miles SW. of Quilpie	4,847	4,847	Plugged as a dry hole	..
		67P (Checkerboarded and interrelated	33,800	Queensland-S.A. Border	Reflection	3·5						
	F.P.C.A.: C. de Lapparent, General Manager, Bennet and Fisher Building 12 Currie Street, Adelaide	..	..	..	F.P.C.A.: Geological Magnetometric Seismic	0·75 9·0 4·0						
Exoil No Liability, C. W. Siller, Chairman, 134 Adelaide Street, Brisbane, L. W. Doggett, Secretary, Box 218D, G.P.O., Brisbane	Titleholder	76P	48,000	Hughenden	Reflection	4		No Drilling Activity				

Gulf Interstate Overseas Ltd., W. J. Steeger, President, 1702 Esperson Building, Houston, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Titleholder	88P Area A 88P Area B	10,500 4,500	Torres Strait Princess Charlotte Bay	Aerial Magneto-metric	4		No Drilling Activity				
Longreach Oil Limited, J. McD. Royle, Managing Director, Box 775, G.P.O., Sydney, W. D. Mott, Consulting Geologist, Astor Court, corner Wharf and Leichhardt Streets, Brisbane	Titleholder	87P Area 1	2,700	Ilfracombe	Reflection	6		No Drilling Activity				
	Farmout Drillers No Liability, Hare and Associates, General Managers, 20 Collins Street, Melbourne (Reading and Bates (Aust.) Pty. Ltd.)	87P Area 2	90	Barcaldine	Geological Gravity	9 1	Farmout Drillers Alice River No. 1	4 miles SE. of Barcaldine	5,352	5,352	Plugged as a dry hole	Area No. 2 is subject to a Farmout Agreement with Farmout Drillers N.L.
Magellan Petroleum (Qld.) Pty. Ltd. (75%), T. S. M. Ranneft, Director, Box 455F, G.P.O., Brisbane, Central Queensland Petroleum Coy. Pty. Ltd. (25%), R. F. G. Wilson, Agent, Box 1555V, G.P.O., Brisbane	American Overseas Petroleum Ltd., O. F. van Deveren, President, 458 Lexington Avenue, New York; E. R. Locke, Manager, Exploration Operations Australia, Box 1086N, G.P.O., Brisbane	80P Area A	5,000	Winton	None			No Drilling Activity				"Amoseas" is operating company for Californian Asiatic Oil Company (Calasiatic) and Texaco Overseas Petroleum Company (Topco) who have an option over 50% of the title and are directing exploration in the area
Magellan Petroleum (Qld.) Pty. Ltd., T. S. M. Ranneft, Director, Box 455F, G.P.O., Brisbane	American Overseas Petroleum Ltd, O. F. van Deveren, President, 458 Lexington Avenue, New York; E. R. Locke, Manager, Exploration Operations, Australia, Box 1086N, G.P.O., Brisbane	80P Area B	18,000	Tambo	Geological Gravity Reflection	1 6 10		No Drilling Activity				
Marathon Petroleum (Australia) Ltd., E. B. Shade, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. R. Loose, Exploration Manager, Box 687K, G.P.O., Brisbane	Titleholder	61P Area A	12,000	Carpentaria Basin	None	..		No Drilling Activity				Area B subject to agreement between Cabot Corporation, Blueberry Oil Corporation, Curran R. Campbell Inc., Associated Australian Oilfields and Marathon Petroleum Australia Ltd., whereby the first four companies hold reserved interests
		61P Area B	8,000	Laura Basin	Reflection	5·5		No Drilling Activity				
Marathon Petroleum (Australia) Ltd. and Continental Oil Company of Australia Ltd. (Equal Shares)	Marathon, E. B. Shade, Vice President, 539 South Main Street, Findlay, Ohio, U.S.A.; C. R. Loose, Exploration Manager, Box 687K, G.P.O., Brisbane (Richter Bawden Drilling Pty. Ltd.)	89P	9,822	Baralaba Duaringa St. Lawrence	Reflection	8	Marathon Continental Glenhaughton No. 1	53 miles NW. of Taroom	7,960	..	Drilling	
Mid-wood Exploration Pty. Ltd., Rees B. Withers, Managing Director, 792 Elizabeth Street, Melbourne, C. 1., J. F. Fitzgerald, Secretary, Box 535H, G.P.O., Brisbane	Titleholder (Glindemann and Kitching Pty. Ltd.)	91P	25,000	Normanton	Reflection Refraction	7 ..	Mid-wood Normanton Scout No. 1		For details see page 11			
							Mid-wood Normanton Scout No. 2		For details see page 11			
Pacific American Oil Company, J. Abernathy, President, Box 8837, Oklahoma City, Oklahoma, U.S.A.; C. W. Siller, Vice President, 134 Adelaide Street, Brisbane, with whom are associated Shell Development (Australia) Proprietary Limited, Lewis Luxton, Chairman; J. Spinks, Exploration Manager; Shell Corner, 155 William Street, Melbourne, C. 1., Victoria	Shell Development (Australia) Pty. Ltd.	70P	10,000	Maryborough Bundaberg	Geological Gravity Reflection Refraction	20 3 8·75 1		No Drilling Activity				

Table B—continued

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1963—continued

Authorities to Prospect Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
The Papuan Apinaipi Petroleum Company Ltd., G. H. R. Jones, Chairman, 53 Martin Place, Sydney, D. M. Traves, Exploration Manager, Box 880L, G.P.O., Brisbane	Petroleum Exploration Co. (Petexco) in association with Mines Administration Pty. Ltd., E. N. Avery, Managing Director, D. M. Traves, Exploration Manager (Richter Bawden Drilling Pty. Ltd., under contract to Phillips Sunray)	54P	34,897	Boulia	None		Phillips Sunray Elizabeth Springs No. 1	55 miles SE. of Boulia	1,113	1,410	Completed as water well	See remarks for Area 86P Elizabeth Springs No. 1 drilled by Phillips-Sunray-Mid Continent under 50% checkerboard interest
Petroleum Exploration Inc., Tulane Gordon, President, 1501 Millie Esperson Building, Houston, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Titleholder	92P Area A	4,000	North of Croydon	None			No Drilling Activity				
		92P Area B	7,200	Croydon	None			No Drilling Activity				
Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 2 O'Connell Street, Sydney	Planet Oil Company No Liability (Delta Drilling Company)	100P Area A	200	Rolleston	None			No Drilling Activity				
		100P Area B	400	Rolleston	Geological	1 5	Planet Warrinilla No. 1	45 miles SSW. of Rolleston	6,701	6,701	Plugged as a dry hole	
							Planet Warrinilla North No. 1	29 miles SSW. of Rolleston	6,879	6,879	Plugged as a dry hole	
Queensland American Oil Co. (25%); Sunray DX Oil Company (37½%); Phillips Petroleum Company (37½%). Phillips: P. J. Parker, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 124, P.O., North Quay, Brisbane	Phillips Petroleum Company (Oil Drilling and Exploration Ltd.)	71P	29,500	Gympie Brisbane Toowoomba	Geological Photogeology Reflection	4 4 1·63	P–S–Q.A Durabilla West No. 1	26 miles WSW. of Cecil Plain	4,429	4,429	Plugged as a dry hole	Phillips–Sunray Queensland American
							P–S–Q.A Tinker Creek No. 1	20 miles SW. of Dunmore	4,207	4,207	Plugged as a dry hole	Phillips–Sunray Queensland American
							P–S–Q.A Waggaba No. 1	40 miles SE. of Tara	4,025	4,025	Plugged as a dry hole	Phillips–Sunray Queensland American
							P–S–Q.A Zig Zag No. 1	50 miles SE. of Tara	2,246	2,246	Plugged as a dry hole	Phillips–Sunray Queensland American
							Phillips–Sunray Cecil Plains No. 1	3 miles E. of Cecil Plains	5,501	5,501	Plugged as a dry hole	Phillips Sunray only
							Phillips–Sunray Kumbarilla No. 1A	10 miles SW. of Kumbarilla	876	876	Junked and Abandoned	Phillips Sunray only
							Phillips–Sunray Kumbarilla No. 1	50 ft. NW. of No. 1A	4,034	4,034	Plugged as a dry hole	Phillips Sunray only

FOOTNOTE.—26 Scout Bores in Charley's Creek area. Depth range 63′ to 490′.

For details see page 11.

L. H. Smart Oil Exploration Co. Ltd., L. H. Smart, Chairman, R. C. Twist, Exploration Manager, Box 2670, G.P.O., Sydney	Alliance Oil Development Australia N.L., H. B. Borwick, Managing Director, 11th Floor, 100 Collins Street, Melbourne, L.W. Doggett, Agent, Box 218D, G.P.O., Brisbane (Reading and Bates (Aust.) Pty. Ltd.) Titleholder	98P	3,000	North of Eromanga	Gravity Reflection	5 4·5	Alliance Canaway No. 1	40 miles WSW. of Adavale	4,937	4,937	Plugged as a dry hole	Area subject to an agreement between L. H. Smart Exploration Co. and Alliance Oil Development Australia N.L.
		99P	8,900	Eromanga	Gravity Reflection Refraction	3 1·35 0·15	No Drilling Activity					
Sunray DX Oil Company (50%) and Phillips Petroleum Company (50%). Phillips: P. J. Parker, Vice President International, Phillips Building, Bartlesville, Oklahoma, U.S.A., J. J. Tanner, Manager Australian Operations, Box 124, P.O., North Quay, Brisbane	Phillips Petroleum Company	72P	35,000	Charleville	Reflection	2·7	No Drilling Activity					
		84P	13,500	Yaraka	Reflection Refraction	9·65 0·19	No Drilling Activity					
Triton of Australia Ltd., C. H. Green, Director, care of North Star Oil Corporation 1007 Midland Savings Building, Midland, Texas, U.S.A.; L. Brundall, Australian Exploration Representative, 30–36 Herschel Street, Brisbane	Titleholder	82P Area A	6,361	Cooktown			No Drilling Activity					
		82P Area B	4,538	West of Chillagoe			No Drilling Activity					
		82P Area C	4,066	North of Charters Towers	Geological	0·5	No Drilling Activity					
		82P Area D	5,010	South of Charters Towers	Photogeology	5	No Drilling Activity					
Union Oil Development Corporation and Kern County Land Company with reserved interest to Australian Oil and Gas Corporation	Union Oil A. C. Rubel, President, Union Oil Centre, Los Angeles, California, U.S.A.; D. Graves, Resident Manager, Box 5048, G.P.O., Sydney, D. E. Pyle, Field Superintendent, P.O. Box 77, Toowoomba	57P	38,000	St. George Miles	Geological Reflection: Goondiwindi Middle Creek MacIntyre Yuleba Moonie River Flinton	12 13·4 7·8 2·0 3·9 2·5 8·6	U.K.A. Bidgel No. 1	9½ miles NE. of Wunger	6,525	6,525	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Brigalow Creek No. 1	25 miles SW. of Tara	5,047	..	Drilling	Contractor—Santa Fe
							U.K.A. Cobbareena No. 1	14 miles NW. of Tara	5,170	5,170	Completed as a water well	Contractor—Santa Fe
							U.K.A. Coomrith No. 1	46 miles SE. of Surat	8,426	8,426	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Cabawin No. 2	21 miles SW. of Tara	10,354	10,354	Completed as a water well	Contractor—Oil Drilling and Exploration
							U.K.A. Cockatoo Creek No. 1	20 miles ENE. of Taroom	4,527	12,082	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Crowder No. 1	43 miles SSW. of Tara	783	5,864	Completed as a water well	Contractor—Oil Drilling and Exploration
							U.K.A. Flinton No. 1	66 miles SW. of Tara	9,123	9,123	Completed as a water well	Contractor—Oil Drilling and Exploration
							U.K.A. Lynrock No. 1	20 miles SSE. of Surat	6,869	6,869	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Liddell No. 1	6 miles SW. of Toombilla	5,757	5,757	Plugged as a dry hole	Contractor—Santa Fe
							U.K.A. Mackie No. 1	21 miles SW. of Chinchilla	3,969	3,969	Plugged as a dry hole	Contractor—Santa Fe
							U.K.A. Moonie No. 11	Moonie Field	470	5,817	Completed as an Oil Well	Contractor—Oil Drilling and Exploration

Table B—continued

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1963—continued

Authorities to Prospect Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							U.K.A. Moonie No. 12	Moonie Field	6,047	6,047	Completed as an injection well	Contractor—Oil Drilling and Exploration
							U.K.A. Moonie No. 13	Moonie Field	6,918	6,918	Completed as an Oil Well	Contractor—Oil Drilling and Exploration
							U.K.A. Moonie No. 14	Moonie Field	6,124	6,124	Completed as an Oil Well	Contractor—Oil Drilling and Exploration
							U.K.A. Moonie No. 15	Moonie Field	5,944	5,944	Completed as an Oil Well	Contractor—Oil Drilling and Exploration
							U.K.A. Moonie No. 16	Moonie Field	6,178	6,178	Completed as an injection well	Contractor—Oil Drilling and Exploration
							U.K.A. Moonie No. 17	Moonie Field	6,010	6,010	Completed as an Oil Well. Dual zone Completion	Contractor—Oil Drilling and Exploration
							U.K.A. Paget No. 1	25 miles NE. of Moonie	5,372	5,372	Plugged as a dry hole	Contractor—Santa Fe
							U.K.A. St. George No. 1	4½ miles NNW. of St. George	4,695	4,695	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Southwood No. 1	15 miles S. of Cabawin No. 1	10,897	10,897	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Tey No. 1	18 miles NW. of Tara	5,374	5,374	Completed as a water well	Contractor—Santa Fe
							U.K.A. Tingan No. 1	9 miles NNW. of Goondiwindi	5,957	5,957	Completed as a water well	Contractor—Oil Drilling and Exploration
							U.K.A. Toombilla No. 1	19 miles SSW. of Tara	5,830	5,830	Plugged as a dry hole	Contractor—Santa Fe
							U.K.A. Toombilla East No. 1	17 miles S. of Tara	5,540	5,540	Plugged as a dry hole	Contractor—Santa Fe
							U.K.A. Undulla No. 1	13 miles WNW. of Tara	8,849	8,849	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Weir No. 1	10½ miles SSE. of Moonie	5,234	5,234	Plugged as a dry hole	Contractor—Santa Fe
							U.K.A. Weribone No. 1	65 miles NW. of Moonie	7,995	7,995	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
							U.K.A. Wunger No. 1	36 miles WNW. of Flinton	6,339	6,339	Plugged as a dry hole	Contractor—Oil Drilling and Exploration
	TOTAL AREA ..	..	728,586 Sq. miles					TOTAL FOOTAGE ..	429,153			

Prospecting Petroleum Permits Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	P.P.P. No.	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
Condamine Oil Ltd., H. V. Mead, Secretary, Box 1717V, G.P.O., Brisbane	..	708	100	North of Chinchilla	Refraction	0·25	Condamine Oil Speculation No. 1	22 miles N. of Chinchilla	160	2,885	Plugged and Abandoned	
Standard Gas Pty. Ltd., L. G. Neill, Managing Director, 307 Queen Street, Brisbane	..	715	200	Brisbane	Geological	..	Standard Gas Sandgate No. 1	Sandgate	1,764	1,764	Suspended	Cable tool well
							Standard Gas Cribb Island No. 1	2½ miles W. of Luggage Point	461	2,901	Suspended	Cable tool well
	TOTAL AREA ..	..	300 Sq. miles				TOTAL FOOTAGE ..		2,385			

SCOUT BORES DRILLED

Well Name	Location	Footage Drilled	Total Depth	Status at Year's End
A.F.O. Norwich Park Scout No. 1	50 miles N. of Emerald ..	755	755	Plugged and abandoned
Midwood Normanton Scout No. 1	30 miles E. of Normanton ..	798	798	Junked and abandoned
Midwood Normanton Scout No. 2	20′ from No. 1 Well	962	..	Drilling
Phillips–Sunray Charley's Creek Nos. 1–26 ..	Mangorilly School, Durong Area	6,182	6,182	Capped and abandoned
	Total Footage	8,697		

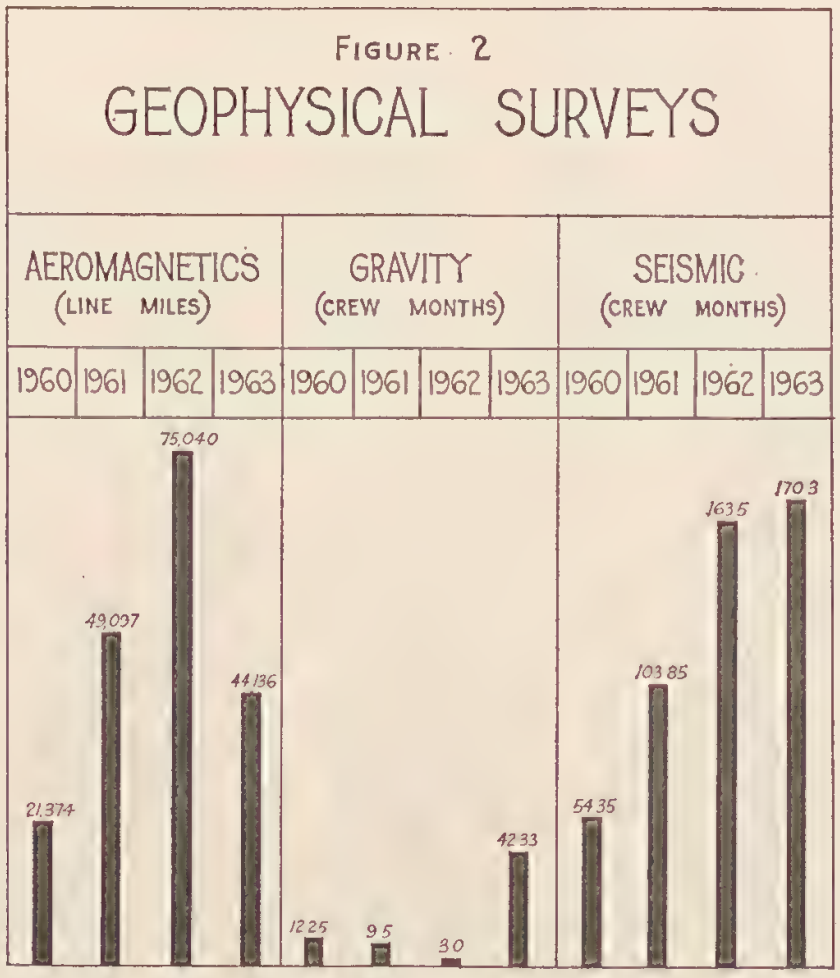
Total Exploration/Appraisal Development footage drilled on Authorities to Prospect ..	429,153
Total Exploration/Appraisal Development footage drilled on Prospecting Petroleum Permits	2,385
Scout Bores	8,697
Grand Total footage drilled	440,235

(See also summary of drilling activities on pages 3 to 10.)

Table C

GEOLOGICAL SURVEYS BY GOVERNMENT AGENCIES, 1963

Area	Sedimentary Basin	Type	Agency	Party-Months
Baralaba 1 : 250,000 area	Bowen, Surat	Regional survey ..	B.M.R./G.S.Q.	5
Springsure 1 : 250,000 area	Drummond, Bowen, Eromanga	Regional survey ..	B.M.R./G.S.Q.	5
Taroom–Mundubbera (west) 1 : 250,000 areas ..	Bowen, Surat	Regional survey ..	B.M.R./G.S.Q.	5
Hughenden–Tangorin–Winton–Muttaburra 1 : 250,000 areas	Eromanga	Regional survey ..	B.M.R./G.S.Q.	5
Laura Basin	Laura	Regional survey ..	B.M.R. ..	2
Maryborough 1 : 250,000 area	Maryborough	Regional survey ..	G.S.Q.	4
Monto 1 : 250,000 area	Yarrol, Bowen	Regional survey ..	G.S.Q.	3
Carnarvon Range–Reids Dome (Taroom–Springsure 1 : 250,000 areas)	Bowen, Surat	Shallow drilling for palynological studies. Total 111 holes, 3,848 ft.	G.S.Q.	3
Springsure–Baralaba–Taroom–Mundubbera (west) 1 : 250,000 areas	Drummond, Bowen, Surat	Shallow drilling in support of regional mapping. Total 31 holes, 4,415 ft.	B.M.R. ..	½
			Total ..	32½



Tables D, E and F have been compiled by Officers of the Geological Survey of Queensland.

Table D

GRAVITY

By Petroleum Companies

Title	Operator	Contractor	Area	Crew Months	Area Covered	Stations Observed
					(Sq. miles)	
70P	Shell Development (Australia) Pty. Ltd.	Petty Geophysical Engineering Company	Maryborough ..	3	2,500	1,142
80P	American Overseas Petroleum Ltd.	Petty Geophysical Engineering Company	Tambo	6	12,000	9,028
81P	Alliance Oil Development Australia N.L.	United Geophysical Corporation	Chesterton ..	3	6,997	1,174
86P	Australian Aquitaine Petroleum Pty. Ltd.	Compagnie Generale de Geophysique	Fermoy	3·33	2,000	1,089
87P	Farmout Drillers N.L. ..	Namco International Inc. ..	Barcaldine ..	1 (Survey not completed)	90	164
98P	Alliance Oil Development Australia N.L.	Geoseismic Ltd.	Quilpie–Windorah	5	3,000	521
99P	L. H. Smart Oil Exploration Company Ltd.	Independex International Inc. ..	Eromanga ..	3	5,470	1,331
		Total by Petroleum Companies	..	24·33	..	14,449

By Government Agencies

Basin	Agency, Operator	Area	Type	Crew Months	Area Covered	Stations Observed
					(Sq. miles)	
Great Artesian ..	Bureau of Mineral Resources, Geology and Geophysics with Division of National Mapping	Longreach, Maneroo, Winton, Mackunda, Muttaburra, Manuka 4 mile areas	Helicopter survey	2	32,000	750
Great Artesian ..	Velocity Surveys with B.M.R. supervision	Richmond, Hughenden, Charters Towers, Tangorin, Buchanan, Galilee, Jericho, Julia Creek, McKinley, Manuka 4 mile areas	Helicopter survey	2	52,500	1,200
Bowen	Velocity Surveys with B.M.R. supervision	Bowen, Proserpine, Mount Coolon, Mackay, Clermont, St. Lawrence, Port Clinton, Emerald, Duaringa, Rockhampton 4 mile areas	Helicopter survey	2	60,000	1,060
Great Artesian, Bowen	Bureau of Mineral Resources, Geology and Geophysics	Area covered by 1963 helicopter surveys	Gravity control for helicopter surveys	5	..	940
Great Artesian ..	Bureau of Mineral Resources, Geology and Geophysics	Tangorin, Buchanan, Galilee 4 mile areas	Semi-detailed, along Exoil seismic traverses	1	..	1,500
Surat	Bureau of Mineral Resources, Geology and Geophysics	Chinchilla, Dalby 4 mile areas	Semi-detailed, along A.O.G. seismic traverses	5	..	2,100
Georgina ..	Bureau of Mineral Resources, Geology and Geophysics	Boulia	Semi-detailed, along B.M.R. seismic traverses	1	..	280
		Total by Government Agencies		18	..	7,830
			Total	42·33	..	22,279

Table E

AEROMAGNETICS

By Petroleum Companies

Title	Operator	Contractor	Area	Area Covered	Line Miles Flown
				(Sq. miles)	
66/67P	Delhi Australian Petroleum Ltd. Ltd.	Adastra Hunting Geophysics Pty. Ltd.	South-west Queensland ..	50,900	13,248
66/67P	French Petroleum (Australia) Pty. Ltd.	Adastra Hunting Geophysics Pty. Ltd.	South-west Queensland ..	30,000	5,650
88P	Gulf Interstate Overseas Ltd. ..	Aero Service Ltd.	Offshore; Cape York–Papua and Princess Charlotte Bay	31,000	3,294
93P	Ampol Exploration (Queensland) Pty. Ltd.	Aero Service Ltd.	Offshore; north of Broad Sound	..	2,431
94P	Ampol Exploration (Queensland) Pty. Ltd.	Aero Service Ltd.	Offshore; south of Bowen ..	..	1,413
		Total	by Petroleum Companies ..	..	26,036

By Government Agencies

Basin	Agency, Operator	Area	Area Covered	Line Miles Flown
			(Sq. miles)	
Bowen	Bureau of Mineral Resources, Geology and Geophysics	Eddystone, Taroom, Roma, Mitchell 4 mile areas	2,500	6,100
Georgina ..	Bureau of Mineral Resources, Geology and Geophysics	Mount Isa, Urandangie, Glenormiston 4 mile areas	5,300	12,000
		Total by Government Agencies ..	..	18,100
			Total ..	44,136

GROUND MAGNETICS

By Petroleum Companies

Title	Operator	Contractor	Area	Crew Months	Area Covered	Stations Observed
					(Sq. miles)	
86P	Australian Aquitaine Petroleum Pty. Ltd.	Compagnie Generale de Geophysique	Fermoy	3·33	2,000	1,091

Table F—SEISMIC—By Petroleum Companies

Title	Operator	Contractor	Area	Crew Months	Type and Method of Survey R. Reconnaissance D. Detail C.P. Continuous Profiling R.P. Reversed Profiling	Area Surveyed	Length of Sub-surface Section	Number of Shot Points	Number of Holes Drilled	Total Footage Drilled	Explo-sives Used	Detona-tors Used
						Sq. Mls	Miles				Lbs.	
55/56P	Mines Administration Pty. Ltd.	Austral Geoprospectors Pty. Ltd.	Roma	10·5	Reflection; C.P.	2,000	502	2,029	2,096	284,480	33,575	2,788
55/56P	Mines Administration Pty. Ltd.	Geophysical Service International S.A.	Emerald	8	Reflection; C.P.	2,500	383	1,431	2,034	227,720	88,249	2,861
57P	Union Oil Development Corporation	United Geophysical Corporation	Goondiwindi–St. George	13·4	Reflection, R.,D.; C.P. and correlation profiling	18,000	820·5	2,794	2,905	466,995	88,903	4,920
57P	Union Oil Development Corporation	United Geophysical Corporation	Middle Creek	7·81	Reflection, R.,D.; C.P.	3,500	454·4	1,436	1,631	304,415	99,398	3,032
57P	Union Oil Development Corporation	United Geophysical Corporation	Macintyre	1·96	Reflection, R.,D.; C.P.	1,000	139·5	434	439	55,925	14,417	698
57P	Union Oil Development Corporation	United Geophysical Corporation	Yuleba	3·92	Reflection, R.,D.; C.P.	2,250	315·2	966	979	159,690	45,892	1,585
57P	Union Oil Development Corporation	United Geophysical Corporation	Moonie River	2·55	Reflection, R.,D.; C.P.	500	100·8	410	465	134,035	34,610	1,225
57P	Union Oil Development Corporation	United Geophysical Corporation	Flinton	8·58	Reflection, R.,D.; C.P.	3,000	620·6	1,960	1,939	327,565	64,256	2,632
61P	Marathon Petroleum Australia Ltd.	General Geophysical Company (Bahamas) Ltd.	Marina Plains	5·5	Reflection, C.P. Refraction	800 ..	175·2 11·7	701 5	820	70,970	30,300	1,389
66/67P	Delhi Australian Petroleum Ltd.	United Geophysical Corporation	McGregor Range	3·5	Reflection, R.; C.P.	2,665	215·1	630	773	91,610	24,270	1,176
66/67P	French Petroleum (Australia) Pty. Ltd.	Compagnie Generale de Geophysique	Annandale	4	Reflection, R.; C.P. Refraction, R.; C.P.	.. ..	263 68·5	652 54	17,398 325	269,980 15,495	81,479	17,071
70P	Shell Development (Australia) Pty. Ltd.	Petty Geophysical Engineering Company	Maryborough	8·75	Reflection, R.D.; C.P.	1,200	326·5	891	6,431	299,034	133,970	7,714
70P	Shell Development (Australia) Pty. Ltd.	Petty Geophysical Engineering Company	Fraser Island	1	Refraction, R.; C.P.	..	33	89	517	27,000	52,678	769
71P	Phillips Petroleum Company	Austral Geoprospectors Pty. Ltd.	Dalby–Cecil Plains	1·63	Reflection, R.; C.P. with skips	206	54·7	282	847	107,795	4,975	1,179
72P	Phillips Petroleum Company	Austral Geoprospectors Pty. Ltd.	Toompine–Wyandra	2·7	Reflection, R.; C.P. with skips	1,700	135	407	1,143	151,875	20,780	1,533
75P	Marathon Petroleum Australia Ltd.	Namco International Inc.	Ruthven	3·5	Reflection; C.P.	800	125	514	607	45,276	11,943	878
76P	Exoil No Liability	Austral Geoprospectors Pty. Ltd.	Torrens Creek	4	Reflection, D.; C.P. Refraction	300	175	703	704	63,882	17,830	815
80P	American Overseas Petroleum Ltd.	Petty Geophysical Engineering Company	Tambo	10	Reflection, R.,D.; C.P. Refraction	1,800	725	2,176	2,396	257,292	56,711	3,000
81P	Alliance Oil Development Australia N.L.	Namco International Inc.	Jericho	5·5 0·5	Reflection; C.P. Refraction	200 ..	313·9 30·3	1,258 31	1,356 33	185,512 4,969	36,340 5,385	1,660
81P	Planet Exploration Company Pty. Ltd.	Austral Geoprospectors Pty. Ltd.	Crystalbrook	1	Reflection; C.P. Refraction Survey not completed	100 ..	16·8 10·2	81 20	198	10,000	..	..
83P	Marathon Petroleum Australia Ltd.	Namco International Inc.	Ruthven	1·5	Reflection; C.P.	575	102	328	394	45,276	11,943	689
84P	Phillips Petroleum Company	Petty Geophysical Engineering Company	Yaraka–Tambo	9·65	Reflection, R.,D.; C.P.	2,370	447·5	1,426	4,710	552,421	69,373	5,509
			Yaraka	0·19	Refraction; inline offset profiling	20	9·9	18	25	3,335	7,005	131
86P	Mines Administration Pty. Ltd.	Namco International Inc.	Longreach	3	Reflection; C.P.	150	198	728	745	98,944	11,550	893
86P	Australian Aquitaine Petroleum Pty. Ltd.	Compagnie Generale de Geophysique	Fermoy	3·33	Reflection; C.P. Refraction	1,500	201	372	1,281	118,815	25,267	1,619
87P	Longreach Oil Ltd.	Geoseismic (Australia) Pty. Ltd.	Rodney Downs	2	Reflection; C.P.	300	83	368	200	19,560	9,655	418
87P	Longreach Oil Ltd.	United Geophysical Corporation	Brixton	1	Reflection; C.P.	200	78·14	237	484	44,435	6,870	547
87P	Longreach Oil Ltd.	Geoseismic (Australia) Pty. Ltd.	Longreach	3	Reflection; C.P.	201	119	554	616	35,800	13,380	689
89P	Marathon Petroleum Australia Ltd.	United Geophysical Corporation	Bauhinia Downs, Mimosa	8	Reflection; C.P.	916	232	802	1,529	147,216	41,346	1,790
91P	Mid-wood Exploration Pty. Ltd.	Austral Geoprospectors Pty. Ltd.	Normanton, Burketown, Iffley	7	Reflection; C.P. Refraction; R.P.	25,000 ..	225 59·1	931 14	1,017	95,840	27,350	1,675
94P	Ampol Exploration (Queensland) Pty. Ltd.	Namco International Inc.	Proserpine	1·5 0·33	Reflection; C.P. Refraction	450 ..	65·5 12·43	264 25	260 25	15,871 3,715	3,170 4,875	307 124
97P	Amalgamated Petroleum Exploration Pty. Ltd.	Prakla (Australia) Pty. Ltd.	Yarrol Basin	1	Reflection, D.; C.P.	50	24	113	113	9,451	2,900	121
98P	Alliance Oil Development Australia N.L.	General Geophysical Company (Bahamas) Ltd.	Windorah	4·5	Reflection; C.P.	600	305·29	1,154	1,010	122,135	15,440	1,510
99P	L. H. Smart Oil Exploration Company Ltd.	Geophysical Associates Pty. Ltd.	Eromanga	1·35 0·15	Reflection; C.P. Refraction	250 ..	74·3 11·3	222 2	235 52	41,925 2,315	5,500 6,410	316 63
P.P.P. 708	B.O.C. of Aust. Ltd.	Austral Geoprospectors Pty. Ltd.	Chinchilla	0·25	Refraction	..	12·5	5	25	4,150	7,200	75
		Total by petroleum companies		163·06								

By Government Agencies

Basin	Agency, Operator	Area	Crew Months	Type and Method of Survey	Area Surveyed	Length of Sub-surface Section	Number of Shot Points	Number of Holes Drilled	Total Footage Drilled	Explo-sives Used	Detona-tors Used
					Sq. Mls	Miles				Lbs.	
Georgina	Bureau of Mineral Resources, Geology and Geophysics	Boulia–Bedourie	5·5	Reflection, D.; C.P. Refraction, D.; R.P.; 10 profiles	.. ..	78 ..	388 98	..	96,397	24,400	..
Eromanga	Bureau of Mineral Resources, Geology and Geophysics	Thargomindah–Noccundra	2	Reflection, D.; C.P. with skips Refraction, D.; R.P.; 3 profiles	.. ..	32·3 ..	133 26	503	37,584	7,340	..
	Total	by Government Agencies	7·5								
	Total		170·56								

PART 2—DRILLING, 1963

Prepared by Petroleum Section, Geological Survey of Queensland.

This section presents in summary form the main information about each of the wells drilled in Queensland for petroleum or for stratigraphic information in 1963. The details of each well were taken from well completion reports and progress reports submitted to the Department of Mines by the companies concerned. The stratigraphic names are those used by the companies, and not necessarily in accordance with the Australian Code of Stratigraphic Nomenclature.

Abbreviations—

N.	North
S.	South
E.	East
W.	West
T.	True
TD	Total depth
PD	Progress depth
KB	Kelly bushing
RT	Rotary table
GL	Ground level
RR	Rig release
Abd	Abandoned
DST	Drill stem test
HFT	Halliburton formation test
BC	Bottom choke
VO	Valve open
ISI	Initial shut-in
TS	To surface
GTS	Gas to surface
OTS	Oil to surface
WTS	Water to surface
MCFD	Thousand cubic feet per day
MMCFD	Million cubic feet per day
BOPD	Barrels oil per day
BPD	Barrels per day
GPH	Gallons per hour
GPD	Gallons per day
TSTM	Too small to measure
GCM	Gas-cut mud
OFP	Open flow potential
Perf.	Perforations/perforated
Fluor.	Fluorescence
Sl.	Slightly
Tr.	Trace
Incr.	Increasing
Decr.	Decreasing
Est.	Estimated
Rec.	Recovered

Note: Status of a completed well is reported as either "Gas (and/or oil) well" or abandoned. Included in the "abandoned" category are wells which produced small flows of hydrocarbon and were plugged; such wells later may be subjected to stimulation and completed as producers.

Table G

EXPLORATION DRILLING

Well	Title	Location	Latitude S. Longitude E.	Elevation	Spud Completion	T.D. (or P.D., 31–12–63)	Intention	Formation Tops	Shows, Tests	Status (31–12–63); Remarks
				Ft.		Ft				
Alliance Canaway No. 1	98P	40 mi. WSW. of Adavale	25°56′05·5″ 143°57′47·4″	783 KB 770 GL	31–5–63 22–6–63 RR	4,937	Test section on culmination of seismic high	surf. Tertiary 80 Winton 1,062 Tambo 2,230 Roma 2,947 Blythesdale 4,010 Walloon 4,230 Hutton 4,854 phyllite	Blythesdale tested 2,962–3,031′, 1,860 GPH fresh water; 3,234–3,271′, rec. 1,000′ fresh water, 350′ mud-cut water; 3,948–3,980′, 3,000 GPH fresh water. Hutton tested 4,618–4,652′, 1,980 GPH fresh water; 4,804–4,891′, 3,300 GPH fresh water	Abd.
Amalgamated Abercorn No. 1	97P	12 mi. SE. of Mulgildie	25°07′55″ 151°12′25″	634 RT 622 GL	29–5–63 22–11–63 RR	8,855	Test upper Palaeozoic on seismic high	surf. Mulgildie 762 Evergreen 1,445 Precipice 1,765 Esk ? 3,913 ? Cabawin ? 6,665 Camboon	Esk showed fluor., cut . Cabawin ? showed CH_4 Camboon showed CH_4 and CO_2; tested 8,608–8,855′, rec. 3,000′ water	Abd.
Amalgamated Morstone No. 1	79P	35 mi. NE. of Camooweal	19°34′15″ 138°30′50″	867 RT 857 GL	20–3–63 22–5–63 RR	2,504	Stratigraphic	surf. Quaternary 30 Split Rock ? 40 Mail Change 55 V Creek 380 Currant Bush 760 Thorntonia 1,100 Paradise Creek ? 1,236 Gunpowder Creek 2,080 Myally	No show or test	Abd.. Fish not recovered; side track unsuccessful
Amalgamated Mulgildie No. 1	97P	½ mi. SSE. of Mulgildie	24°58′25″ 151°08′05″	708 RT 698 GL	2–4–63 18–5–63 RR	4,013	Stratigraphic	surf. Mulgildie 1,097 Evergreen 1,784 Precipice 2,190 Cabawin ? 3,850 granodiorite	No show or test	Abd.
A.A.O. Apple Grove No. 1	55/56P	8 mi. SE. of Roma	26°40′55″ 148°51′06″	937 RT 927 GL	19–10–63 29–10–63 RR	4,144	Test lower Mesozoic on axis of Roma Ridge, down structure from Ingle culmination	surf. Roma 250 Blythesdale 1,648 " Injune Creek " 2,988 Hutton 3,585 Evergreen 3,932 Precipice 4,016 Moolayember 4,113 Timbury Hills	Precipice tested 3,919–3,989′; BC ½″; VO 90 min.; GTS 1 min., 1·64 MMCFD; rec. 120′ mud, show condensate	Gas well
A.A.O. Arbroath No. 1	55/56P	21 mi. WSW. of Roma	26°41′00″ 148°28′00″	1,171 RT 1,156 GL	18–7–63 20–8–63 RR	8,367	Stratigraphic	Surf. Roma 1,055 Blythesdale 2,445 " Injune Creek " 3,496 Hutton 4,135 Evergreen 4,458 Precipice 4,595 Permian " Unit 8 " 8,275 Timbury Hills	No show or test	Abd.
A.A.O. Bardloming No. 1	55/56P	17 mi. SE. of Roma	26°43′40″ 149°01′04″	1,039 KB 1,028 GL	26–10–63 11–11–63 RR	4,695	Test lower Mesozoic on seismic high	surf. Roma 622 Blythesdale 1,945 " Injune Creek " 3,380 Hutton 4,013 Evergreen 4,375 Precipice 4,418 Moolayember 4,654 " Showgrounds " 4,663 Bandanna	Precipice tested 4,385–4,405′, GTS 31 min., flow TSTM, rec. 30′ GCM Moolayember sand 4,485–4,504′, showed gas. " Showgrounds" showed fluor.; tested 4,643–4,695′, GTS 4 min., flow TSTM, rec. 10′ mud	Abd.
A.A.O. Bony Creek No. 1	55/56P	16 mi. SE. of Roma	26°45′00″ 148°58′00″	1,040 RT 1,030 GL	16–3–63 12–4–63 RR	4,583	Test lower Mesozoic on seismic high	surf. Roma 540 Blythesdale 1,992 " Injune Creek " 3,326 Hutton 3,961 Evergreen 4,294 Precipice 4,348 Moolayember 4,493 Timbury Hills	Precipice tested 4,340–4,387′; BC½″; VO 90 min.; 2.05 MMCFD. Perf. 4,305–4,308′, 4,322–4,329′, OFP 2·35 MMCFD. Moolayember showed high gas in mud; tested 4,423–4,494′, rec. 20′ mud. Timbury Hills showed black hydrocarbon; tested 4,505–4,570′, rec. 20′ mud.	Gas well. Perf. 4,305–4,308′, 4,322–4,329′

Table G—continued

EXPLORATION DRILLING—continued

Well	Title	Location	Latitude S. Longitude E.	Elevation	Spud Completion	T.D. (or P.D., 31–12–63)	Intention	Formation Tops	Shows, Tests	Status (31–12–63); Remarks
A.A.O. Brucedale No. 1	55/56P	25 mi. SSE. of Roma	26°54′51″ 148°56′39″	Ft. 976 KB 964 GL	27–9–63 12–10–63 RR	Ft. 5,255	Test lower Mesozoic on west culmination of seismic high	Surf. " Glenmorgan " 240 Roma 712 Blythesdale 2,336 " Injune Creek " 3,668 Hutton 4,275 volcanics 4,500 Evergreen 4,747 Precipice 4,842 Moolayember 5,012 granite wash (veneer of " Showgrounds ") and granite	Precipice showed gas bleeding; tested 4,768–4,825′, GTS 44 min., rec. 4,800′ brackish water. Granite wash (" Showgrounds "?) showed fluor. and cut; tested 4,978–5,033′, rec. 30′ mud; tested 4,981–5,122′, rec. 105′ mud	Abd.
A.A.O. Ingle No. 1	55/56P	5 mi. SE. of Roma	26°38′50″ 148°49′10″	992 RT 982 GL	3–9–63 16–9–63 RR	4,202	Test lower Mesozoic on seismic high on Roma Ridge	Surf. Roma 451 Blythesdale 1,632 " Injune Creek " 2,812 Hutton 3,562 Evergreen 3,927 Precipice 3,948 Moolayember 4,061 Timbury Hills	Precipice tested 3,881–3,965′, rec. 50′ mud. Timbury Hills tested 4,105–4,202′, rec. 15′ mud	Abd.
A.A.O. Kildare No. 1	55/56P	12½ mi. NW. of Injune	25°43′16″ 148°24′46″	1,604 KB 1,590 GL	1–2–63 7–3–63 RR	5,724	Test Permian in pinch-out	surf. Hutton 950 Boxvale 1,124 Evergreen 1,330 Precipice 1,624 Moolayember 1,750 Rewan 2,410 Bandanna 3,010 Mantuan 3,090 " Dry Creek " 3,445 Permian "Unit 4" ? Permian, "Unit 5" ? Permian, " Unit 6 " (basal sand) 3,682 Permian, "Unit 7" 3,760 Permian, "Unit 8"	Permian, " Unit 6 " basal sand tested 3,664–3,701′, rec. 1,450′ brackish water. Permian, " Unit 8 " showed fluor., cut and gas; tested 3,830–3,882′, rec. 40′ mud, tr. fluor.; 4,050–4,110′, rec. 510′ GCM; 4,237–4,304′, rec. 210′ GCM, tr. fluor.; 4,307–4,520′, GTS 60 min., CH_4 TSTM, valve mud-cut	Abd.
A.A.O. Kildare No. 2	55/56P	14 mi. NW. of Injune	25°43′09″ 148°23′00″	1,627 KB 1,613 GL	13–4–63 25–5–63 RR	7,667	Test pinch-out higher than in A.A.O. Kildare No. 1 and onto north culmination of Glentulloch Structure	surf. Hutton 955 Boxvale 1,108 Evergreen 1,292 Precipice 1,626 Moolayember 1,805 Bandanna 2,449 Mantuan 2,565 " Dry Creek " 2,890 Permian, " Units, 4, 5, 6 " (basal sand 3,045–3,056′) 3,056 Permian, "Unit 7" 3,145 Permian, "Unit 8" 7,070 Permian, " Unit 10 "	Permian, " Unit 6 " basal sand tested 2,996–3,065′, GTS 30 min. TSTM, rec. 180′ mud, 2,645′ water. Permian, " Unit 8 " tested 3,481–3,550′, rec. 100′ GCM; 3,896–4,040′, GTS 25 min., TSTM, rec. 327′ GCM; 4,713–4,750′, rec. 120′ GCM; 5,246–5,290′, rec. 280′ mud	Abd.
A.A.O. Lorelle No. 1	55/56P	36 mi. ESE. of Roma	26°48′30″ 149°19′20″	999 RT 984 GL	29–5–63 12–7–63 RR	9,065	Stratigraphic	surf. " Glenmorgan " 15 Roma 1,260 Blythesdale 2,587 " Injune Creek " 4,332 Hutton–Boxvale 5,080 " sub unit 1 " Jurassic 5,242 " sub unit 2 " Jurassic 5,267 " sub unit 3 " Jurassic 5,430 " sub unit 4 " Jurassic 5,540 " sub unit 5 " Jurassic 6,030 " sub units 6 and 7 " Triassic	Rewan showed gas; tested 7,573–7,590′, rec. 60′ GCM, tr. oil. " Early Storms " tested 8,569–8,768′, rec. 470′ sl. GCM	Abd.

								6,395 "sub unit 8" Triassic 6,515 "sub unit 9" Triassic 6,575 Showgrounds 6,733 Rewan 7,705 Bandanna 8,085 Mantuan 8,213 "Dry Creek" 8,605 "Early Storms" 8,947 volcanics		
A.A.O. Lorne No. 1	55/56P	24 mi. WSW. of Roma	26°42′15″ 148°26′00″	1,113 RT 1,098 GL	23–9–63 4–10–63 RR	4,250	Test Precipice and Evergreen on seismic high, up dip from A.A.O. Arbroath No. 1	surf. Roma 769 Blythesdale 2,100 "Injune Creek" 3,050 Hutton 3,732 Evergreen 4,025 Precipice 4,227 Permian, "Unit 8"	Evergreen tested 3,830–3,891′, rec. 3,895′ water. Precipice tested 4,035–4,089′, rec. 10′ mud; 4,144–4,250′, 1,100 GPH water	Abd.
A.A.O. Richmond No. 1	55/56P	9 mi. SE. of Roma	26°40′30″ 148°53′00″	979 KB 968 GL	13–8–63 31–8–63 RR	4,130	Test lower Mesozoic on seismic high	surf. Roma 514 Blythesdale 1,749 "Injune Creek" 3,041 Hutton 3,643 Evergreen 4,003 Precipice 4,084 Moolayember	Precipice tested 4,010–4,062′, GTS 4 min., 95 MCFD, OTS 43 min., 1,000 BOPD (43°API)	Oil well. Perf. 4,005·5–4,013′
A.A.O. Roma South No. 1	55/56P	1¼ mi. 143°T of A.A.O. No. 4 (Hospital Hill)	26°35′17″ 148°47′10″	1,012·5KB 1,001 GL	30–7–63 11–8–63 RR	3,854	Test lower Mesozoic on S. flank of Hospital Hill structure	surf. Roma 250 ? Blythesdale 1,410 "Injune Creek" 2,668 Hutton 3,270 Evergreen 3,662 Precipice 3,788 ? Moolayember	Precipice tested 3,689–3,735′, GTS 50 min., TSTM, rec. 50′ GCM	Abd. Converted to water well, prod. from Blythesdale
A.A.O. Sunnybank No. 1		For details see Annual Report of Department of Mines for 1962 and G.S.Q. Publication 299, Third Supplement								Oil well, limited reservoir. Perf. 5,850–5,890′
A.A.O. Westgrove No. 3		For details see Appraisal and Development (page 25), also Annual Report of Department of Mines for 1962, and G.S.Q. Publication 299, Third Supplement								
A.F.O. Bandanna No. 1	55/56P	54 mi. NNW. of Injune	25°06′40″ 148°17′20″	1,430 RT 1,420 GL	31–5–63 23–6–63 RR	4,041	Test Permian on Bandanna culmination of Serocold Anticline	surf. "Early Storms" 210 Ingelara 796 Aldebaran 1,418 Cattle Creek 2,247 Permian, "Unit 8"	"Early Storms" showed fluor. Aldebaran showed fluor. and cut. Cattle Creek showed fluor., cut and gas bleeding; tested 2,116–2,156·5′, rec. 210′ GCM. Permian, "Unit 8" showed gas, fluor. and cut; tested 2,609–2,650′, rec. 160′ GCM; 3,583–3,623′, GTS 25 min., TSTM, rec. 80′ GCM	Abd.
A.F.O. Inderi No. 1	55/56P	15½ mi. NW. of Rolleston	24°17′00″ 148°29′00″	720 RT 710 GL	29–6–63 15–8–63 RR	5,433	Test Permian in seismic high	surf. Alluvium 60 volcanics 92 Bandanna 1,170 Mantuan 1,250 "Dry Creek" 1,669 "Early Storms" 1,686 Ingelara 1,869 Aldebaran 3,821 Cattle Creek 5,368 Stanleigh	Aldebaran showed gas, fluor., oil; tested 1,818–1,901′, BC½″; VO 60 min.; GRS 2 min., 800 + MCFD with watery mud, rec. 510′ muddy water; 2,332–2,466′, rec. 2,266′ muddy water Cattle Creek tested 3,814–3,944′, salt water TS 56 min., 440 BPD, GTS 56 min. TSTM; 4,358–4,407′, rec. 120′ mud.	Abd.
A.F.O. Purbrook No. 1	55/56P	15½ mi. SE. of Rolleston	24°37′10″ 148°48′20″	793 RT 783 GL	21–8–63 25–9–63 RR	4,949	Test Permian on crest of large culmination on Purbrook Anticline	surf. Rewan 538 Bandanna 1,497 "Dry Creek" 1,855 "Early Storms" 2,040 Ingelara 3,037 Aldebaran 3,825 Cattle Creek 4,758 Timbury Hills	Aldebaran showed gas bleeding, oil droplets and fluor. in Core 8 (3,816–3,825′) No test	Abd.
A.F.O. Rolleston No. 1	55–56P	7 mi. S. of Rolleston	24°33′47″ 148°37′52″	686·5RT 675 GL	20–10–63	7,837 PD	Test Permian on culmination of seismic high	..	..	Drilling
Condamine Oil Ltd. No. 1 (Speculation)	P.P.P. 708	22 mi. N. of Chinchilla	26°28′33″ 150°39′48″	1,067 RT 1,064 GL	5–8–48 10–4–63 Abd	2,885	Test section on divined site (later seismic showed off-structure)	surf. Hutton 913 Evergreen 1,765 Camboon	All formations reported to show oil and gas; some confirmed by analysis. No test	Abd.

Table G—continued

EXPLORATION DRILLING—continued

Well	Title	Location	Latitude S. Longitude E.	Elevation	Spud Completion	T.D. (or P.D., 31–12–63)	Intention	Formation Tops	Shows, Tests	Status (31–12–63); Remarks
Delhi–Santos Naryilco No. 1	66/67P	200 mi. SW. of Quilpie	28°27′03·8″ 141°42′22·7″	Ft. 449 KB 433 GL	7–2–63 19–2–63 RR	Ft. 4,847	Determine and test high-velocity beds below ± 5,600′ on seismic high	surf. Tertiary and Recent 120 Winton 1,457 Tambo 2,082 " Fishscale " 2,200 Roma 3,223 " Transition " 3,512 Mooga 4,153 ? Walloon 4,556 ? Triassic 4,739 ? Proterozoic	Walloon showed fluor. and cut. No test	Abd.
Farmout Drillers Alice River No. 1	87P, Area 2	4½ mi. SE. of Barcaldine	23°37′08″ 145°19′15″	882 KB 868 GL	6–2–63 27–3–63 RR	5,352	Test section in pinch-out down dip from culmination of seismic high	surf. Tertiary 60 Tambo 148 Roma 767 Blythesdale 1,672 Moolayember 1,890 Clematis 2,721 Permian, "Unit 1" 2,822 Permian, "Unit 2" 3,215 Permian, "Unit 3" 3,468 Permian, "Unit 4" 3,844 Permian, "Unit 5" 5,290 Permian, "Unit 6"	Blythesdale tested 1,121–1,155′, rec. 1,095′ muddy fresh water. Clematis tested 1,876–1,910′, rec. 1,830′ muddy fresh water. Permian " Unit 2 " tested 3,134–3,168′, rec. 15′ sl. watery mud. Permian " Unit 3 " tested 3,302–3,336′, 600 GPH fresh water. Permian " Unit 5 " tested 3,836–3,870′, rec. 1,670′ fresh water	Abd.
Marathon–Continental Glenhaughton No. 1	89P	53 mi. NW. of Taroom	25°12′30″ 149°07′45″	1,829 KB 1,814 GL	17–11–63	7,960 PD	Stratigraphic test on seismic anomaly	..	..	Drilling
Phillips–Sunray–Queensland American Durabilla West No. 1	71P	26 mi. WSW. of Cecil Plains	27°34′23″ 150°46′37″	1,226 KB 1,215 GL	2–8–63 19–8–63 RR	4,429	Test Precipice on flank of SW. culmination of Durabilla Anticline	surf. Blythesdale 1,874 Walloon 3,074 Hutton 3,694 Evergreen 4,078 Precipice 4,378 andesite	No show or test	Abd.
Phillips–Sunray–Queensland American Tinker Creek No. 1	71P	29 mi. SW. of Cecil Plains	27°45′25″ 150°47′46″	1,155 KB 1,143 GL	10–9–63 26–9–63 RR	4,207	Test Precipice on fault-closed structure	surf. Blythesdale 1,642 Walloon 2,794 Hutton 3,426 Evergreen 4,007 Precipice 4,184 indur. mudstone	No show Hutton tested 2,790–2,865′, rec. 180′ mud, 2,413′ fresh water. Precipice tested 3,992–4,056′, rec. 240′ mud, 450′ freshwater	Abd.
Phillips–Sunray–Queensland American Waggaba No. 1	71P	25 mi. SW. of Cecil Plains	27°42′01″ 150°54′58″	1,136 KB 1,125 GL	23–8–63 7–9–63 RR	4,025	Test Precipice on seismic high	surf. Blythesdale 1,257 Walloon 2,472 Hutton 3,094 Evergreen 3,630 Precipice 3,769 indur. sandstone	No show Hutton tested 2,470–2,556′, rec. 150′ mud, 2,208′ fresh water. Evergreen tested 3,181–3,341′, rec. 2·5′ mud. Precipice tested 3,520–3,721′, rec. 4′ mud; 3,733–3,821′, rec. 240′ mud, 1,460′ fresh water	Abd.
Phillips–Sunray–Queensland American Zig Zag No. 1	71P	21 mi. W. of Millmerran	27°53′25″ 150°55′43″	1,161 KB 1,150 GL	28–9–63 6–10–63 RR	2,246	Test Hutton and Evergreen sands on seismic high	surf. Blythesdale 942 Walloon 1,701 Hutton 2,051 Pre Precipice ? 2,216 hornfels	No show Hutton tested 1,935–2,101′, rec. 120′ mud. 210′ fresh water	Abd.
Phillips–Sunray Cecil Plains No. 1	71P	3·3 mi. E. of Cecil Plains	27°31′57″ 151°14′50″	1,178 KB 1,167 GL	7–10–63 9–11–63 RR	5,501	Test Precipice on minor arch with inferred closure (seismic)	surf. Blythesdale 641 Walloon 2,168 Hutton 2,964 Evergreen 3,768 Precipice 4,252 Upper-Middle Triassic 5,216 Lower Triassic ?	No show Hutton tested 2,203–2,330′, rec. 150′ mud, 2,030′ fresh water; 2,880–3,050′, rec. 90′ mud Evergreen tested 3,065–3,285′, rec. 500′ mud, 1,785′ fresh water Precipice tested 3,832–3,950′, rec. 420′ mud, 2,930′ fresh water	Abd.
Phillips–Sunray Kumbarilla No. 1A	71P	35 mi. SW. of Dalby	27°25′38″ 150°47′06″	1,276 KB 1,265 GL	12–11–63 16–11–63 RR	876	Test Precipice on seismic high	surf. Blythesdale	No show or test	Abd. after operational difficulty
Phillips–Sunray Kumbarilla No. 1	71P	35 mi. SW. of Dalby. 50 ft. NW. of Kumbarilla No. 1A	27°25′38″ 150°47′06″	1,276 KB 1,265 GL	19–11–63 5–12–63 RR	4,034	Test Precipice on seismic high	surf. Blythesdale 1,598 Walloon 2,848 Hutton 3,600 Evergreen 4,004 tuff	No show Hutton tested 2,905–3,048′, rec. 240′ mud, 2,319′ fresh water. Evergreen tested 3,825–3,935′, rec. 10′ mud	Abd. To be converted to water well above 845′

Planet-Warrinilla No. 1	100P	45 mi. SSW. of Rolleston	25°06′49″ 148°33′14″	1,021 KB 1,005 GL	12–5–63 20–7–63 RR	6,701	Test Permian on structural high on Warrinilla Trend	surf. Quaternary 90 Rewan 1,117 Bandanna 2,477 Catherine 2,759 Ingelara 3,232 Aldebaran 3,584 Cattle Creek 4,897 Pre-Cattle Creek	Rewan showed gas; tested 1,441–1,481′, rec. 10′ mud. Bandanna showed gas and fluor. Catherine showed gas and fluor., tested 2,478–2,508′, rec. 5′ mud; 2,550–2,577′, rec. 5′ mud. Aldebaran showed gas, fluor., cut; tested 3,238–3,279′, rec. 40′ sl. GCM; 3,237–3,310′, rec. 200′ sl. GCM; 3,361–3,382′, BC ⅛″, VO 2 hr., GTS 4 min., 108 MCFD decr. to 88 MCFD in 2 hr.; rec. 30′ GCM; 3,361–3,396′, BC ⅛″, VO 2½ hr., GTS 55 min., 10 MCFD decr. to TSTM; rec. 60′ GCM; 3,395–3,427′, rec. 200′ GCM; 3,421–3,462′, BC ⅛″, VO 2 hr., GTS 30 min., TSTM (est. 5′ MCFD); 3,456–3,498′, rec. 40′ GCM; 3,494–3,583,′ rec. 120′ very GCM. Cattle Creek showed gas and fluor.; tested 4,085–4,126′, rec. 50′ GCM; 4,167–4,209′, BC ⅛″, VO 60 min., GTS 2 min., 175 MCFD decr. to 140 MCFD in 1 hr., rec. 150′ GCM; 4,230–4,303′, rec. 20′ sl. GCM; 4,690–4,762′, rec. 30′ sl. GCM; 4,769–4,870′, rec. 40′ GCM, tr. oil. Pre-Cattle Creek showed gas and fluor.: tested 5,763–5,865′, rec. 300′ mud.	Abd.
Planet-Warrinilla North No. 1	100P	29 mi. SSW. of Rolleston	24°52′49″ 148°31′50″	1,036 KB 1,020 GL	28–7–63 30–10–63 RR	6,879	Test Permian on culmination on N. plunge of Warrinilla Trend	surf. Quaternary 55 Rewan 1,704 Bandanna 2,945 Mantuan 3,068 Catherine 3,450 Ingelara 4,010 Aldebaran 5,645 Cattle Creek 6,643 Pre-Cattle Creek	Bandanna showed gas; tested 2,000–2,072′, rec. 5′ mud; tested 2,228–2,264′, rec. 100′ mud. Mantuan showed gas and oil; tested 2,955–2,991′, rec. 10′ mud. Catherine showed gas and oil. Ingelara showed gas and oil; tested 3,722–3,813′, BC ⅛″, VO 60 min., GTS 20 min., 65 MCFD, rec. 330′ gassy mud, 90′ salt water. Aldebaran showed gas and oil; tested 4,005–4,030′, BC ⅛″, VO 70 min., GTS 53 min., est. 5 MCFD, rec. 50′ GCM; 4,027–4,062′, BC ⅛″, VO 120 min., GTS 2 min., 112 MCFD, rec. 130′ GCM; 4,061–4,120′, BC ⅛″, VO 90 min., GTS 30 min., est. 10 MCFD; rec. 90′ sl. GCM; 4,342–4,410′, rec. 75′ mud; 4,535–4,553′, BC ⅛″, VO 133 min., GTS 26 min., 44 MCFD, rec. 125′ GCM; 4,510–4,573′, BC ⅛″, VO 61 min., GTS 45 min., TSTM (est. 5 MCFD), rec. 120 GCM; 4,686–4,716′, rec. 210′ sl. GCM; 5,123–5,233′, rec. 200′ mud; 5,363–5,381′, rec. 15′ mud; 5,374–5,414′, rec. 350′ mud; 5,410–5,467′, rec. 70′ sl. GCM; 5,510–5,575′, BC ⅛″, VO 96 min., GTS 5 min., 44 MCFD incr. to 102 MCFD after 90 min., rec. 300′ GCM; 5,574–5,644′, BC ⅛″, VO 64 min., GTS 1 min., 250 MCFD decr. to 162 MCFD, MTS 52 min., WTS 61 min., rec. 675′ gassy brackish water. Pre-Cattle Creek showed gas; tested 6;350–6,438′, rec. 10′ mud	Abd.

Table G—continued

EXPLORATION DRILLING—continued

Well	Title	Location	Latitude S. Longitude E.	Elevation	Spud Completion	T.D. (or P.D., 31–12–63)	Intention	Formation Tops	Shows, Tests	Status (31–12–63); Remarks
				Ft.		Ft.				
Standard Gas Sandgate No. 1	P.P.P. 704	No. 2 Lagoon Park, Sandgate	27°19′12″ 153°03′55″	..	10–4–63	1,764	Test Mesozoic and possible Permian on anticline	..	..	Suspended (13–6–63)
Standard Gas, Cribb Island No. 1	P.P.P. 704	1 mi. S. of Cribb Island State School	27°22′25″ 153°07′03″	.. ±10 GL	23–2–60	2,901	Test Mesozoic at divined site on flank of gravity high	..	..	Suspended (5–3–63)
Union–Kern–A.O.G. Bidgel No. 1	57P	31 mi. SSE. of Surat	27°34′38″ 149°14′04″	1,123 KB 1,109 GL	14–12–63 29–12–63 RR	6,525	Test lower Mesozoic on seismic high	surf. Roma 2,323 Blythesdale 4,696 Walloon 5,300 Hutton 5,880 Evergreen 6,077 " Wandoan " 6,515 basement	No show or test	Abd.
Union–Kern–A.O.G. Brigalow Creek No. 1	57P	25 mi. SSW. of Tara	27°37′03″ 150°20′12″	933 KB 921 GL	22–12–63	5,047	Test Precipice on Moonie Trend	..	..	Drilling
Union–Kern–A.O.G. Cobbareena No. 1	57P	14 mi. NW. of Tara	27°05′38″ 150°17′09″	1,104 KB 1,092 GL	28–10–63 10–11–63 RR	5,170	Test Precipice in possible stratigraphic trap on Cabawin Trend	surf. Roma 690 Blythesdale 2,324 Walloon 3,610 Hutton 4,384 Evergreen 4,811 Precipice 5,126 " Kianga "	Precipice showed stain, fluor., cut in C Cl_4. No test	Abd. Leased for conversion to water well above 1,522′
Union–Kern–A.O.G. Cockatoo Creek No. 1	57P	±20 mi. ENE. of Taroom	25°34′22″ 150°06′11″	674 KB 656 GL	13–11–62 8–4–63 RR	12,082	Test Permian on structural closure	surf. Hutton ? 210 Evergreen ± 340 Precipice 660 " Cabawin " 3,309 " Kianga " 5,582 Back Creek 11,918 " Cracow "	Precipice " Cabawin " and " Kianga " showed fluor. Back Creek showed gas; tested 9,440–9,480′, rec. net rise 30′ GCM; 11,040–11,066′, rec. net rise 540′ sl. GCM	Abd.
Union–Kern–A.O.G. Coomrith No. 1	57P	46 mi. SE. of Surat	27°38′14″ 149°34′08″	876 KB 862 GL	20–9–63 12–10–63 RR	8,426	Test Precipice on closed structure	surf. Roma 2,774 Blythesdale 5,237 Walloon 5,998 Hutton 6,633 Evergreen equiv. 7,187 Precipice equiv. 7,413 " Wandoan " 8,412 " Cabawin "	No show or test	Abd.
Union–Kern–A.O.G. Crowder No. 1	57P	±43 mi. SSW. of Tara	27°52′36″ 150°15′34″	868 KB 855 GL	22–12–62 17–1–63 RR	5,864	Test Precipice in possible stratigraphic trap on Crowder nose	surf. Roma 1,346 Blythesdale 3,430 Walloon 4,323 Hutton 4,850 Evergreen 5,385 Precipice 5,620 " Kuttung "	Evergreen showed fluor. and cut. Precipice showed fluor. and cut; tested 5,388–5,434′; rec. net rise 3,835′ gassy fresh water	Abd. Converted to water well, prod. from Blythesdale
Union–Kern–A.O.G. Flinton No. 1	57P	66 mi. SW. of Tara	27°54′52″ 149°40′10″	833 KB 819 GL	10–8–63 16–9–63 RR	9,123	Test Precipice on closed structure	surf. Roma 2,685 Blythesdale 5,069 Walloon 5,737 Hutton 6,302 Evergreen 6,857 Precipice 7,192 " Wandoan " 7,908 " Cabawin " 8,300 " Kianga " 8,863 Back Creek 9,030 " Kuttung "	Evergreen showed fluor. " Wandoan " showed fluor. and tr. cut	Abd. [Converted to water well above 4,490′
Union–Kern–A.O.G. Liddell No. 1	57P	22½ mi. SSW. of Tara	27°35′26″ 150°21′36″	943 KB 932 GL	24–11–63 9–12–63 RR	5,757	Test Precipice on possible closure between U.K.A. Middle Creek No. 1 and U.K.A. Toombilla No. 1 (Moonie Trend)	surf. Roma 1,120 Blythesdale 3,162 Walloon 4,250 Hutton 5,030 Evergreen 5,418 Precipice 5,740 " Kuttung "	Precipice showed fluor.; tested 5,555–5,582′, rec. net rise 80′ fresh water; 5,599–5,644′, rec. net rise 480′ watery mud, 600′ muddy water, 2,420′ fresh water	Abd.

Union–Kern–A.O.G. Lynrock No. 1	57P	20 mi. SSE. of Surat	27°26′08″ 149°09′55″	954 KB 940 GL	17–11–63 7–12–63 RR	6,869	Test "Wandoan" sands, or equivalent, on closed structure	surf. Roma 2,320 Blythesdale 4,515 Walloon 5,205 Hutton 5,740 Evergreen 6,170 "Wandoan" 6,630 "Kianga" 6,810 metamorphics	"Wandoan" showed fluor. and [illegible], tested 6,611–6,627', rec. 45' mud	Abd.
Union–Kern–A.O.G. Mackie No. 1	57P	21 mi. SW. of Chinchilla	26°56′16″ 150°21′35″	1,061 KB 1,050 GL	11–12–63 21–12–63 RR	3,969	Test stratigraphic trap, Cabawin Trend	surf. Blythesdale 1,216 Walloon 2,452 Hutton 3,230 Evergreen 3,710 Precipice 3,913 basement	Precipice tested 3,754–3,770', rec. net rise 1,645' sl. gassy fresh water	Abd.
Union–Kern–A.O.G. Paget No. 1	57P	13 mi. SSE. of Tara	27°27′46″ 150°31′31″	1,048 KB 1,037 GL	12–11–63 24–11–63 RR	5,372	Test Precipice on possible structural closure on Moonie Trend	surf. Roma 483 Blythesdale 2,500 Walloon 3,698 Hutton 4,402 Evergreen 4,950 Precipice 5,281 Back Creek	No show or test	Abd.
Union–Kern–A.O.G. St. George No. 1	57P	4½ mi. NNW. of St. George	27°58′48″ 148°32′48″	690 KB 676 GL	6–11–63 13–11–63 RR	4,695	Stratigraphic test, on possible closure	surf. Roma 2,287 Blythesdale 4,070 Walloon 4,448 Hutton 4,584 schist	No show or test	Abd.
Union–Kern–A.O.G. Southwood No. 1	57P	±15 mi. S. of U.K.A. Cabawin No. 1	27°42′40″ 150°13′50″	883 KB 869 GL	11–3–63 4–6–63 RR	10,897	Test Permian on domal closure	surf. Roma 1,542 Blythesdale 4,065 Walloon 5,118 Hutton 5,850 Evergreen 6,370 Precipice 6,825 "Cabawin" 7,375 "Kianga" 7,995 Back Creek	Walloon, Hutton and Evergreen showed tr. fluor. Precipice showed tr. fluor.; good reservoir pot. "Cabawin" showed tr. fluor. and CH_4; imperm. no reservoir pot. "Kianga" showed tr. to strong fluor. and CH_4; imperm. no reservoir pot. Back Creek showed tr. gas, fluor., oil odour; imperm., no reservoir pot	Abd. with fish in hole
Union–Kern–A.O.G. Tey No. 1	57P	18 mi. NW. of Tara	27°08′37″ 150°13′31″	961 KB 949 GL	31–8–63 17–9–63 RR	5,374	Test Precipice in possible stratigraphic trap on Cabawin Trend	surf- Roma 210 Blythesdale 2,565 Walloon 3,770 Hutton 4,600 Evergreen 4,980 Precipice 5,334 Back Creek	Precipice showed fluor., tested 5,141–5,150', rec. net rise 2,222' fresh water	Abd. Leased for conversion to water well above 1,794'
Union–Kern–A.O.G. Tingan No. 1	57P	±9 mi. NNW. of Goondiwindi	28°25′07″ 150°15′12″	700 KB 683 GL	30–6–63 15–7–63 RR	5,957	Test Lower Mesozoic and Permian on seismic high	surf. Roma 1,552 Blythesdale 3,529 Walloon 4,170 Hutton 4,728 Evergreen 5,028 Precipice 5,329 "Cabawin" 5,698 "Kianga" 5,824 Back Creek	No show or test	Abd.
Union–Kern–A.O.G. Toombilla No. 1	57P	±19 mi. SSW. of Tara	27°33′13″ 150°25′40″	974 KB 963 GL	17–9–63 3–10–63 RR	5,830	Test Precipice. in possible stratigraphic trap on Moonie Trend	surf. Roma 990 Blythesdale 2,982 Walloon 4,147 Hutton 4,835 Evergreen 5,418 Precipice 5,820 "Kuttung"	Evergreen showed fluor. No test	Abd.
Union–Kern–A.O.G. Toombilla East No. 1	57P	17 mi. S. of Tara	27°31′37″ 150°28′20″	1,006 KB 995 GL	16–10–63 28–10–63 RR	5,540	Test Precipice on Moonie Trend	surf. Roma 727 Blythesdale 2,769 Walloon 4,001 Hutton 4,675 Evergreen 5,214 Precipice 5,510 "Kuttung"	No show or test	Abd.
Union–Kern–A.O.G. Undulla No. 1	57P	±13 mi. WNW. of Tara	27°13′40″ 150°16′04″	956 KB 943 GL	22–1–63 6–3–63 RR	8,849	Test Precipice in possible stratigraphic trap on Cabawin Trend; evaluate Permian	surf. Roma ? 730 Blythesdale 2,920 Walloon 4,162 Hutton 4,928 Evergreen 5,398 Precipice 5,656 "Kianga" 6,182 Back Creek 8,700 "Kuttung"	Evergreen showed tr. fluor. Precipice tested 5,554–5,647', rec. net rise 4,984' sl. gassy fresh water. "Kianga" showed fluor., odour, stain and cut; tested 5,848–5,874', rec. net rise 1,020' gassy fresh water. Back Creek showed fluor	Abd.

Table G—continued

EXPLORATION DRILLING—continued

Well	Title	Location	Latitude S. Longitude E.	Elevation	Spud Completion	T.D. (or P.D., 31–12–63)	Intention	Formation Tops	Shows, Tests	Status (31–12–63); Remarks
				Ft.		Ft.				
Union–Kern–A.O.G. Weir No. 1	57P	10½ mi. SSE. of Moonie Town	27°51′52″ 150°25′11″	894·5 KB 883·5 GL	3–10–63 15–11–63 RR	5,234	Test Precipice in possible stratigraphic trap on Weir Trend	2,829 Walloon 3,828 Hutton 4,480 Evergreen 4,892 Precipice 5,126 " Kuttung "	No show or test	Abd.
Union–Kern–A.O.G. Weribone No. 1	57P	21 mi. ESE. of Surat	27°19′38″ 149°21′02″	1,115 KB 1,098 GL	15–4–63 25–5–63 RR	7,995	Test Lower Mesozoic and Permian on domal closure	surf. Roma 2,284 Blythesdale 4,547 Walloon 5,290 Hutton 5,940 Evergreen 6,533 " Wandoan " 7,149 " Cabawin " 7,446 " Kianga " 7,760 " Timbury Hills "	" Wandoan " showed fluor. and good oil odour; tested 7,066–7,089′; BC ⅝″, VO 60 min., GTS 17 min., 150 MCFD, rec. net rise 60′ GCM. " Cabawin " showed gas, fluor. and fleeting odour. " Kianga " showed gas	Abd.
Union–Kern–A.O.G. Wunger No. 1	57P	35½ mi. SSE. of Surat	27°40′45″ 149°07′34″	1,005 KB 995 GL	15–10–63 3–11–63 RR	6,339	Test Precipice or equivalent on closed structure	surf. Roma 2,547 Blythesdale 4,740 Walloon 5,228 Hutton• 5,647 Evergreen 5,842 " Wandoan " 6,306 Timbury Hills	" Wandoan " tested 6,283–6,301′, BC ⅝″, VO 90 min′, flowed gross 740 BPD 98% fresh water cut, net 10 BOPD, 60° API, 180 MCFD; 6,281–6,290′, rec. net rise 180′ sl. gassy mud, 540′ sl. gassy watery mud, 5,110′ sl. gassy water	Abd.

Table H

APPRAISAL AND DEVELOPMENT

Well	Title (A.P.)	Location	Latitude (S.) Longitude (E.)	Elevation	Spud Completon	T.D. (or P.D., 31–12–63)	Intention	Shows, Tests	Status, Remarks
				Ft.		Ft.			
A.A.O. Bony Creek No. 2	55/56P	1·4 mi. 316°T. from A.A.O. Bony Creek No. 1	26°44′10″ 148°57′40″	995 RT 985 GL	16–4–63 5–5–63 RR	4,646	Appraisal, Bony Creek structure	DST 1. 4,238–4,290′; BC ½″; VO 120 min.; GTS 1 min., 3·4 MMCFD, pipe dry. DST 2. 4,415–4,515′; EC ½″; VO 90 min.; GTS 63 min., TSTM; rec. 150′ oil emulsion, 305′ oil cut water, 670′ oil-flecked water, 2,009′ water	Gas well
A.A.O. Bony Creek No. 3	55/56P	1·12 mi. 330°T, from A.A.O. Bony Creek No. 2	26°43′10″ 148°57′00″	955 RT 945 GL	6–5–63 20–5–63 RR	4,632	Appraisal, Bony Creek structure	DST 1. 4,149–4,265′; BC ½″; VO 60 min.; GTS 4 min., 160 MCFD; rec. 330′ gas-cut mud	Abd.
A.A.O. Bony Creek No. 4	55/56P	0·5 mi. 180°T, from A.A.O. Bony Creek No. 2	26°44′26″ 148°57′20″	1,039 RT 1,029 GL	10–11–63 18–11–63 RR	4,500	Appraisal, Bony Creek structure	DST 1. 4,284–4,500′; BC ½″; VO 90 min.; GTS 2 min., 2·34 MCFD; rec. 200′ gas-cut mud	Gas well
A.A.O. Bony Creek No. 5	55/56P	1·35 mi. 131°T, from A.A.O. Bony Creek No. 1	26°45′43″ 148°59′13″	936 KB 925 GL	20–11–63 4–12–63 RR	4,330	Appraisal, Bony Creek structure	DST 1. 4,233–4,343; BC ½″; VO 88 min.; GTS 2 min., 6·53 MMCFD; rec. 10′ condensate. DST 2. 3,472–3,540′; BC ½″; VO 99 min.; WTS 63 min., 16,450 GPD	Gas well
A.A.O. Bony Creek No. 6	55/56P	5,728 ft. 360°T, from A.A.O. Bony Creek No. 1	36°44′00″ 148°58′18″	1,038 KB 1,027 GL	6–12–63 17–12–63 RR	4,510	Appraisal, Bony Creek structure	DST 1. 4,316–4,510′; BC ½″; VO 60 min.; GTS 2 min., 5·4 MMCFD; rec. 15′ condensate	Gas well
A.A.O. Bony Creek No. 7	55/56P	1 mi. 90°T. from A.A.O. Bony Creek No. 6	26°44′00″ 148°59′13″	977 KB 966 GL	19–12–63 2–1–64 RR	4,711	Appraisal, Bony Creek structure	DST 1. 4,370–4,440′; BC ½″; VO 90 min.; GTS 26 min., TSTM; rec. full string muddy water DST 2. 4,637–4,711′; BC ½″; 90 min.; no GTS; rec. 11′ mud. DST 3. 4,371–4,389′; BC ½″; VO 90 min.; no GTS; rec. 474′ muddy gas-cut water. DST 4. 4,371–4,404′; BC ½″; VO 100 min.; GTS 36 min., TSTM; rec. 4,000′ muddy water. DST 5. 4,179–4,257′; BC ½″; VO 90 min.; no GTS; rec. 292′ muddy water	Gas well

A.A.O. Richmond No. 2	55/56P	½ mi. 162°T. from A.A.O. Richmond No. 1	26°41′00″ 148°53′03″	972 KB 961 GL	18–9–63 3–10–63 RR	4,201	Appraisal, Richmond structure	DST 1. 3,925–4,045′; BC ½″; VO 90 min.; no GTS; rec. 10′ mud	Abd.
A.A.O. Richmond No. 3	55/56P	2,615 ft. 341°T. from A.A.O. Richmond No. 1	26°40′08″ 148°52′46″	992 KB 981 GL	4–10–63 18–10–63 RR	4,883	Appraisal, Richmond structure	DST 1. 4,781–4,883′; BC ½″; VO 60 min.; no GTS; rec. 50′ mud. DST 2. 4,029–4,170′; BC ½″; VO 120 min.; no GTS; rec. 550′ water	Abd.
A.A.O. Richmond No. 4	55/56P	½ mi. 253°T. from A.A.O. Richmond No. 1	26°40′42″ 148°52′25″	1,005 KB 994 GL	30–10–63 9–11–63 RR	4,400	Appraisal, Richmond structure	DST 1. 4,103–4,155′; BC ½″; VO 60 min.; rec. 700′ water. DST 2. 4,248–4,403′; BC ½″; VO 60 min.; rec. 40′ mud	Abd.
A.A.O. Richmond No. 5	55/56P	2⅛ mi. 203°T. from A.A.O. Richmond No. 1	26°42′00″ 148°52′14″	1,068 KB 1,057 GL	10–11–63 24–11–63 RR	4,370	Appraisal, Richmond structure	DST 1. 4,155–4,190′; BC ½″; VO 120 min.; GTS 4 min., 550 MCFD; OTS 36 min., 270 BOPD; rec. full pipe oil, 90′ gas- and oil-cut muddy water DST 2. 4,192–4,373′; BC ½″; VO 90 min.; no GTS; rec. 250′ water	Gas and oil well
A.A.O. Richmond No. 6	55/56P	1·9 mi. 144°T. from A.A.O. Richmond No. 1	26°41′56″ 148°53′00″	926 KB 915 GL	25–11–63 4–12–63 RR	4,242	Appraisal, Richmond structure	DST 1. 4,194–4,242′; BC ½″; VO 90 min.; no GTS; rec. 180′ oil- and gas-cut muddy water	Abd.
A.A.O. Richmond No. 7	55/56P	2,268 ft. 79°T. from A.A.O. Richmond No. 5	26°41′54″ 148°52′43″	1,010 KB 999 GL	5–12–63 17–12–63 RR	4,200	Appraisal, Richmond structure	DST 1. 4,070–4,097′; BC ½″; VO 90 min.; GTS 4 min., 6·0 MMCFD; rec. 30′ clear condensate	Gas well
A.A.O. Richmond No. 8	55/56P	½ mi. 350°T. from A.A.O. Richmond No. 5	26°41′34″ 148°52′08″	1,036 KB 1,025 GL	18–12–63 29–12–63 RR	4,201	Appraisal, Richmond structure	DST 1. 4,072–4,102′; BC ½″; VO 90 min.; GTS on ISI (2 min.), 3·46 MMCFD; rec. 50′ condensate DST 2. 4,110–4,131′; BC ½″; VO 90 min.; GTS on ISI (2 min.), 1·20 MMCFD; rec. 3′ condensate	Gas well
A.A.O. Richmond No. 9	55/56P	0·5 mi. 170°T. from A.A.O. Richmond No. 5	26°42′26″ 148°52′20″	1,074 KB 1,063 GL	30–12–63	425	Appraisal, Richmond structure	..	Drilling
A.A.O. Sunnybank No. 2	55/56P	0·5 mi. E. from A.A.O. Sunnybank No. 1	26°56′25″ 149°13′59″	840 RT 824 GL	18–1–63 12–3–63 RR	7,244	Appraisal, Sunnybank stratigraphic trap	DST 1. 5,204–5,218′; BC ⅜″; VO 20 min.; no flow; tight. DST 2. 5,428–5,496′; BC ⅜″; VO 122 min.; no flow; tight. DST 4. 5,522–5,590′; BC ⅜″; VO 123 min.; no flow; rec. 180′ very muddy gas-cut water; tight. DST. 6. 6,152–6,164′; BC ⅜″; VO 50 min.; no flow; tight. DST 7. 6,180–6,214′; BC ⅜″; VO 120 min.; small quantity gas. DST 9. 6,262–6,286′; BC ⅜″; VO 30 min.; small quantity gas. DST 10. 6,570–6,592′; BC ¼″; VO 143 min.; GTS 8 min., 225 MCFD; rec. 2,200′ oil (41°API), 100′ gas-cut oil-mud emulsion; perm. DST 11. 6,571–6,592′; BC ¼″; VO 121 min.; GTS 5 min., 210 MCFD; rec. 720′ oil (41°API); low perm. DST 16. 7,043–7,244′; BC ⅜″; VO 52 min.; GTS 7 min., TSTM	Abd.
A.A.O. Sunnybank No. 3	55/56P	2,542 ft. W. from A.A.O. Sunnybank No. 1	26°56′25″ 149°13′02″	835 KB 819 GL	16–3–63 10–4–63 RR	6,622	Appraisal, Sunnybank stratigraphic trap	DST 1. 5,745–5,802′; BC ½″; VO 120 min.; rec. 70′ gas-cut mud; imperm. DST 2. 5,812–5,865′; BC ½″; VO 180 min.; GTS 37 min., TSTM; rec. 150′ gas-cut, slightly oil-flecked mud; low perm. DST 3. 5,939·5–6,000′; BC 5/16″; VO 90 min.; GTS 22 min., est. 200 MCFD; rec. 190′ gas-oil-mud emulsion; low perm. DST 4. 6,037–6,098′; BC 5/16″; VO 60 min.; rec. 120′ sl. gas-cut mud; low perm.	Abd.
A.A.O. Sunnybank No. 4	55/56P	1 mi. 90°T. from A.A.O. Sunnybank No. 2	26°56′25″ 149°14′50″	862 KB 851 GL	27–8–63 19–9–63 RR	7,145	Appraisal, Sunnybank stratigraphic trap	DST 1. 6,635–6,675′; BC ½″; GTS 5 min., 60 MCFD, decr. to 20 MCFD; rec. 2,000′ oil (43·8° API), 120′ gas-oil-mud emulsion, 828′ water	Abd.
A.A.O. Westgrove No. 3	55/56P	±1 mi. S. from A.A.O. Westgrove No. 2	25°34′00″ 148°26′00″	1,732 RT 1,719 GL	24–8–62 18–1–63 RR	12,663	Appraisal/exploratory; test sands met at 2,800′ and 2,900′ in A.A.O. Westgrove No. 2, and investigate section to basement	DST 1. 2,748–2,802′; BC 5/16″; VO 90 min.; GTS 5 min., 541 MCFD; perm. DST 2. 2,855–2,911′; BC 5/16″; VO 80 min.; GTS 2 min., 852 MCFD; perm. DST 3. 3,001–3,028′; BC 5/16″; VO 61 min.; GTS 30 min., TSTM; rec. 1,700′ salt water; perm. DST 4. 4,092–4,160′; BC 5/16″; tool could not be operated after 1 hr flow period; trace salty water recovered from tool after fishing; probl. some perm. DST 5. 8,269–8,354′; BC 5/16″; VO 30 min.; no flow; imperm. DST 6. 12,303–12,360′; BC ⅜″; VO 115 min.; GTS 63 min., 226 MCFD; test inconclusive, probl. poor perm. DST 8. 12,303–12,450′; BC ⅜″; VO 90 min.; no GTS in 90 min., when packer seat failed; poor perm.	Gas well

Table H—continued

APPRAISAL AND DEVELOPMENT—continued

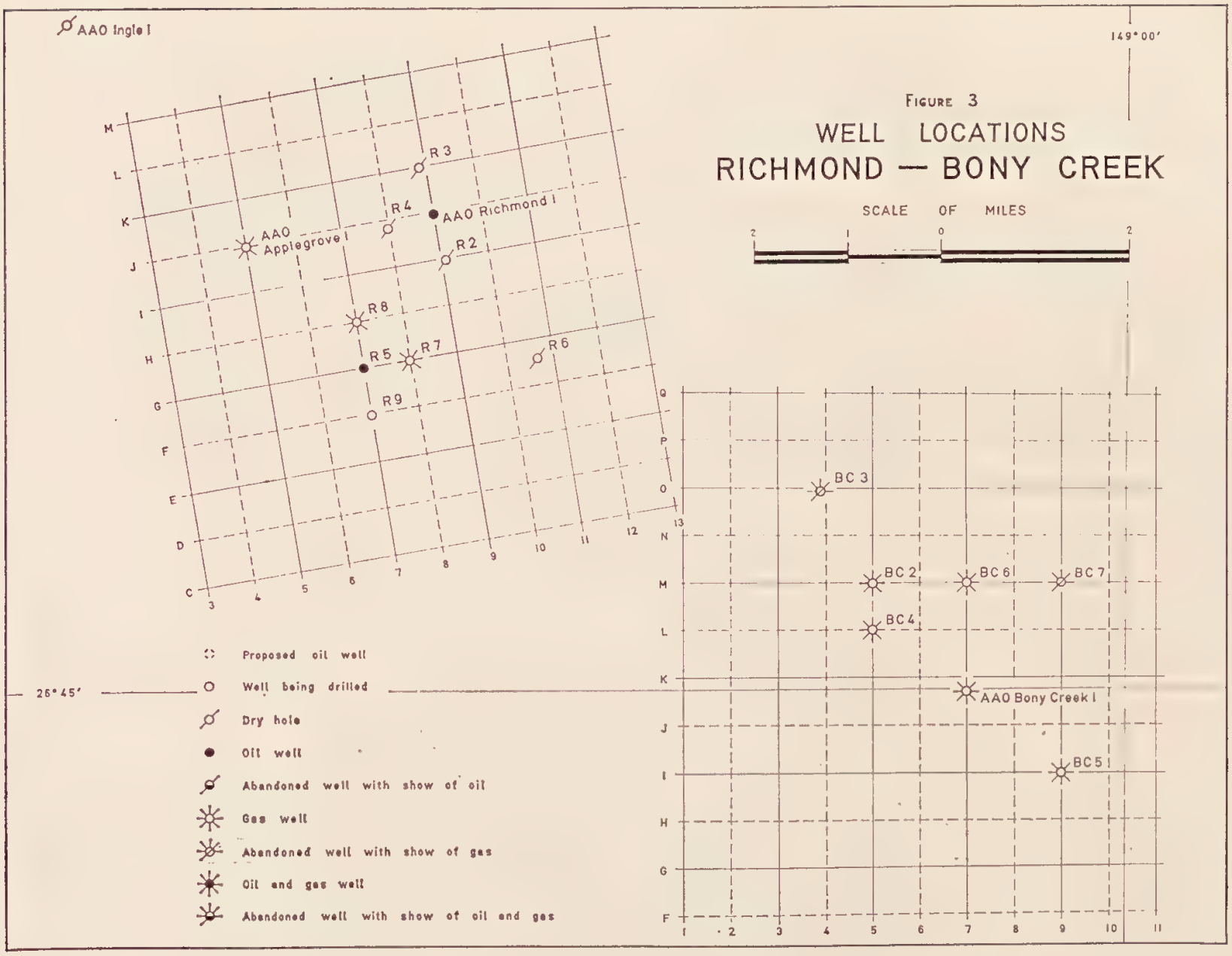
Well	Title (A.P.)	Location	Latitude (S.) Longitude (E.)	Elevation	Spud Completion	T.D. (or P.D., 31–12–63)	Intention	Shows, Tests	Status, Remarks
A.A.O. Westgrove No. 4	55/56P	1 mi. W. from A.A.O. Westgrove No. 2	25°33′00″ 148°25′00″	Ft. 1,725 RT 1,715 GL	19–7–63 17–8–63 RR	Ft. 3,107	Appraisal, Westgrove structure	DST 1. 2,973–3,025′; BC ½″; VO 60 min.; no GTS; rec. 1,160′ salt water. DST 2. 3,076–3,107′; BC ½″; VO 60 min.; no GTS; rec. 2,353′ salt water	Abd.
A.F.O. Rolleston No. 2	55/56P	1·4 mi. 45°T. from A.F.O. Rolleston No. 1	24°32′58″ 148°38′48″	695 KB 679 GL	11–12–63	3,683	Appraisal, Rolleston structure	..	Drilling
U.K.A. Cabawin No. 2	57P	1 mi. NNE. from Cabawin No. 1	27°29′02″ 150°11′35″	956 KB 944 GL	9–6–63 5–8–63 RR	10,354	Appraisal, Cabawin structure	DST. 6,686–6,709′; BC ⅜″; VO 60 min.; rec. net rise 1,620′ fresh water. DST. 10,126–10,143′; BC ⅜″; VO 70 min.; GTS 28 min., 205 MCFD; rec. 1,360′ gross; 90′ green, condensate 51°API, 1,030′ gassy muddy water, 240′ gassy watery mud	Abd. Converted to water well, prod. from Blythesdale
U.K.A. Moonie No. 11	57P	1·8 mi. SW. from U.K.A. Moonie No. 1	27°45′50″ 150°14′04″	882 KB 870 GL	21–12–62 7–1–63 RR	5,817	Appraisal, Moonie structure	..	Oil well. Perf. 5,752–5,781′; 5,783–5,792′
U.K.A. Moonie No. 12	57P	3·1 mi. SW. from U.K.A. Moonie No. 1	27°46′37″ 150°13′17″	879 KB 867 GL	11–1–63 29–1–63 RR	6,047	Appraisal Moonie structure	HFT 1. 5,873–5,891′; BC ⅜″; VO 60 min.; net rise 5,355′ fresh water	Suspended
U.K.A. Moonie No. 13	57P	2·2 mi. WSW. from U.K.A. Moonie No. 1	27°45′44″ 150°13′31″	880 KB 866 GL	2–2–63 18–3–63 RR	6,918	Appraisal, Moonie structure	Perf. 5,820–5,828′; BC ⅜″; VO 15½ hr; swabbed total 7,800′ clean oil (45°API) in 9 hr test	Oil well. Perf. 5,820–5,828′
U.K.A. Moonie No. 14	57P	0·5 mi. S. from U.K.A. Moonie No. 1	27°45′12″ 150°15′26″	890 KB 876 GL	22–3–63 15–4–63 RR	6,124	Appraisal, Moonie structure	Perf. 5,678–5,682′; BC ⅜″; VO 60 min.; net rise 300′ oil, 3,600′ fresh water Perf. 5,816–5,822′, 5,829–5,840′; BC ⅜″; VO 9½ hr; 762 BOPD gas, in 8 hr test on ⅜″ bean	Oil well. Perf. 5,816–5,822′; 5,829–5,840′
U.K.A. Moonie No. 15	57P	1·4 mi. SW. from U.K.A. Moonie No. 1	27°45′42″ 150°14′16″	886 KB 872 GL	18–4–63 7–5–63 RR	5,944	Development, Moonie structure	Perf. 5,812·5–5,820′; BC ⅜″; VO 5 hr; 1,512 BOPD (45°API), 240 MCFD, in 4½ hr test on ⅜″ bean	Oil well. Perf. 5,812·5–5,820′
U.K.A. Moonie No. 16	57P	2·1 mi. NE. from U.K.A. Moonie No. 1	27°43′26″ 150°16′53″	898 KB 884 GL	13–5–63 29–5–63 RR	6,178	Appraisal, Moonie structure	..	Suspended
U.K.A. Moonie No. 17	57P	0·5 mi. W. from U.K.A. Moonie No. 1	27°44′45″ 150°14′54″	887 KB 873 GL	3–6–63 22–6–63 RR	6,010	Development, Moonie structure	Perf. 5,644–5,648′; 5,654–5,664′; BC ⅜″; 107 hr; 1,098 BOPD, 192 MCFD, in 3 hr test on 38/64″ bean Perf. 5,780–5,795′, 5,805–5,822′; BC ⅜″; VO 5 hr 35 min.; 1,066 BOPD (45°API), 213 MCFD, in 1 hr test on 32/64″ bean	Oil well. Perf. 5,644–5,664′; 5,780–5,822′

SCOUT DRILLING

Well	Title	Location	Latitude S. Longitude E.	Elevation	Spud Completion	T.D. (or P.D., 31–12–63)	Intention	Formation Tops	Shows, Tests	Status (31–12–63); Remarks
A.F.O. Norwich Park Scout No. 1	55/56P	50 mi. N. of Emerald	22°42′00″ 148°23′00″	Ft. 724 GL	25–10–63 31–10–63	Ft. 755	Stratigraphic	surf. Middle Bowen 488 Devonian–Carboniferous ?	No show or test	Abd.
Mid-Wood Normanton Scout No. 1	91P	30 mi. ENE. of Normanton	17°39′00″ 141°32′00″	..	16–10–63 2–12–63	798	Stratigraphic	surf. Lynd 390 ? Normanton ?	..	Abd.
Mid-Wood Normanton Scout No. 2	91P	30 mi. ENE. of Normanton 20 ft. from No. 1	17°39′00″ 141°32′00″	..	12–12–63 0–1–64	962	Stratigraphic	..	..	Suspended
Phillips–Sunray Charley's Creek Scouts Nos. 1–26	71P	40 mi. N. to N.E. of Chinchilla	26°–26°30′ 150°30′–151°30′	..	13–5–63 16–6–63	490 (max) 63 (min)	Stratigraphic; prove presence of Evergreen up dip from Hutton outcrop	Deeper holes bottomed in Evergreen Palaeozoics, granite	..	Abd. Total footage: 6,182′

FIGURE 3

WELL LOCATIONS
RICHMOND — BONY CREEK



Members of the official party inspecting the Moonie Production Station before the opening ceremony on 25th March, 1963. They are (L. to R.): The Member for Maranoa, Mr. W. Brimblecombe, M.H.R.; the Member for Balonne, Mr. E. J. Beardmore, M.L.A.; the Minister for Mines, the Hon. E. Evans, M.L.A.; Union Oil's Field Superintendent, Mr. D. Pyle, and the Resident Manager of the Union Oil Development Corporation, Mr. D. T. Graves.

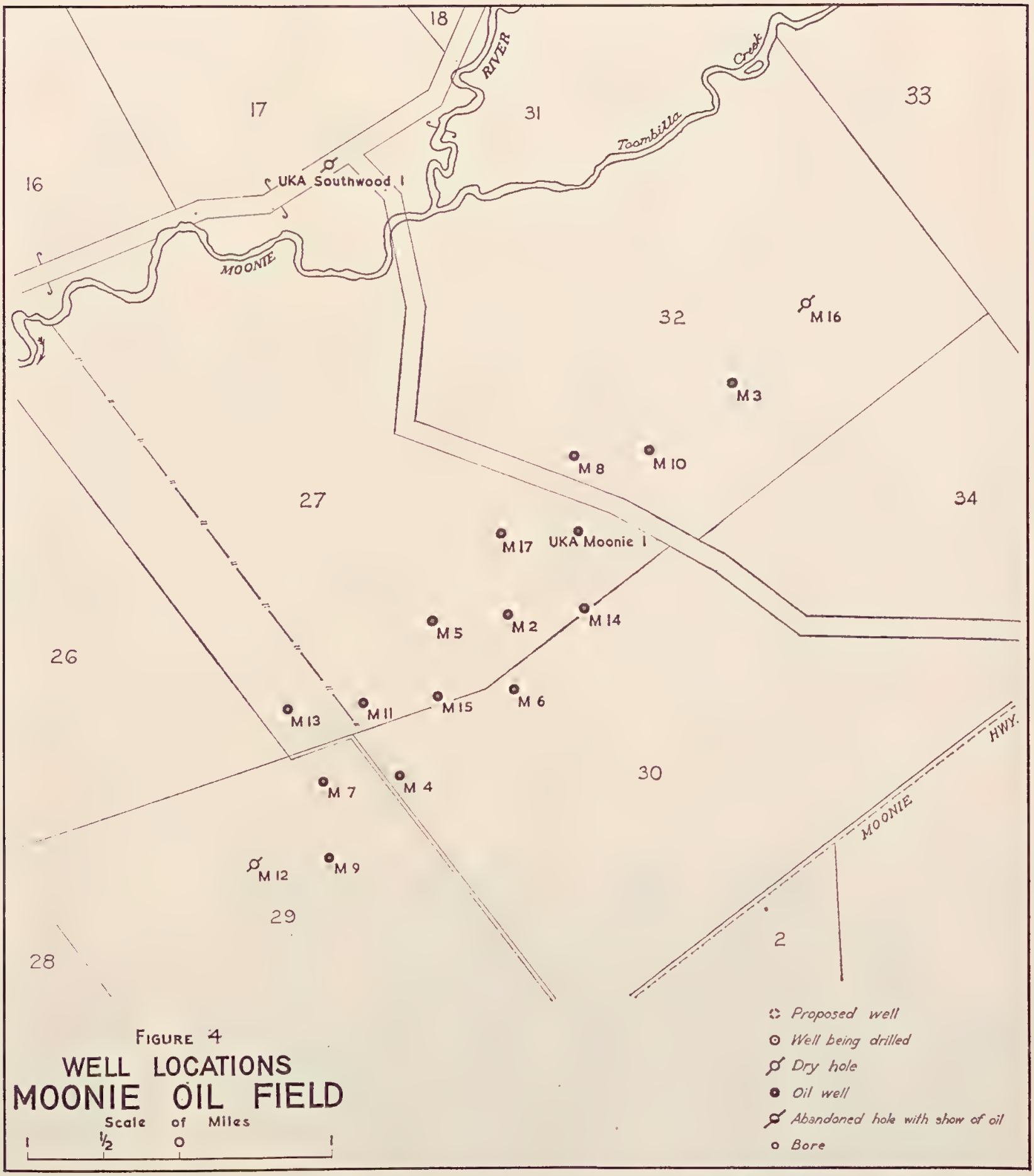


FIGURE 4

WELL LOCATIONS

MOONIE OIL FIELD

PART 3—EMPLOYMENT AND ACCIDENTS

Employment in the industry has maintained its upward trend with an increase of just over 100 to a new total of 765 personnel engaged in the operational field during the year.

The number of personnel employed in the various categories of the industry is set out in Table below, the figures being averaged out to represent total employment for the year. The main increases are seen in the number of geologists and geophysicists engaged on field survey work, in increased clerical and administrative staff, and to a lesser extent in increased drilling personnel.

In light of the twofold increase in drilling activity, it is once again surprising that the number employed in drilling has not shown a greater increase over last year's total. For 1963, total drilling personnel is 181 an increase of only 36 during the year, and this small increase is evidently a reflection of increased operational efficiency coupled with the trend to the lighter more portable type of drilling rig, suited to development/appraisal drilling and operated by a smaller drilling crew.

When the increase in personnel is compared against a total footage drilled for the year nearly double that for 1962, industry must be congratulated on an excellent improvement in operational efficiency. At the same time, accident statistics tabulated in Table I show a threefold increase over the number of accidents in 1962, and though, fortunately, no fatalities occurred in 1963, the drastic increase in accidents must be viewed with considerable disquiet.

During the year, 95 lost time accidents occurred on or about drilling rigs, and of these, 21 were fractures or severed extremities.

As might be expected, nearly half of the accidents occurred whilst handling tubulars, and this only serves to emphasise the need for extreme care especially with inexperienced crews working on the smaller derrick floors of today's mobile rigs.

It must be brought most forcibly to the attention of both operating companies and drilling contractors that in their drive for increased drilling speeds and operating efficiency, they must not lose sight of the need to ensure an adequate level of safety for their personnel.

TABLE I

EMPLOYMENT

Field														Office and Administration			Total
Geological and Geophysical Surveys				Exploration Drilling				Others	Development Drilling				Others	Operator's Employees			
Geologists and Geophysicists		Technicians and Helpers		Supervisors, Petroleum Engineers, Geologists, Toolpushers, and Drillers		Drilling Crews			Supervisors, Petroleum Engineers, Geologists, Toolpushers, and Drillers		Drilling Crews			Geologists and Geophysicists	Drilling	Clerical and Administration	
Employed by		Employed by		Employed by		Employed by			Employed by		Employed by						
Operator	Contractor	Operator	Contractor	Operator	Contractor	Operator	Contractor		Operator	Contractor	Operator	Contractor					
40	63	4	280	13	28	6	95	22	10	7	..	22	8	41	10	116	765

TABLE J

CLASSIFICATION OF ACCIDENTS
(Lost Time only)

Nature of Injuries	Occupation					Injured Members									Agency of Injury					
	Toolpushers	Drillers	Drilling Crews	Others	Total	Fingers	Hands	Arms	Toes	Feet	Legs	Head	Eyes	Body	Total	Moving Machinery	Using tools	Handling Tubing	Falling Objects	Other Causes	Total
Sprains, Contusions Abrasions, Cuts and Lacerations	1	3	63	3	70	14	10	4	..	7	11	2	4	18	70	2	5	32	5	26	70
Fractures	..	2	17	2	21	8	3	1	..	3	1	..	..	5	21	1	..	13	2	5	21
Burns	..	..	3	..	3	..	..	..	..	..	..	..	1	2	3	..	..	..	..	3	3
Other Injuries	..	..	..	1	1	..	..	..	..	..	..	..	..	1	1	..	..	..	..	1	1
Totals	1	5	83	6	95	22	13	5	..	10	12	2	5	26	95	3	5	45	7	35	95

Lost time Incurred—	Man days
Toolpushers	4
Drillers	68
Drilling Crews	1,426
Others	63
Total	1,561

PART 4—LEGISLATION

No changes in legislation were enacted during the year, but the introduction of new regulations to govern the exploration for and production of petroleum has been studied, and a preliminary draft code was prepared. The draft code has been submitted to all other States and to the Commonwealth in an effort to achieve uniformity, and a copy has also been supplied to industry.

It is hoped that finality in this matter will be reached in the coming year, and that the result will be of benefit both to industry and to the regulatory bodies.

PART 5—GENERAL SURVEY OF THE INDUSTRY

In spite of an increase of almost 100 per cent. in the number of wells drilled, 1963 has proved to be a disappointing year for exploration in that no new major fields have been discovered in the State.

In fact, the only company that can claim any real success from their operations is Associated Australian Oilfields, a member of the Associated Group, which has proven up several small gas structures and a limited oil reserve in the Richmond-Bony Creek area near Roma, and a further gas structure at Rolleston.

The supply of gas to the Roma Power Station from the wells A.A.O. Timbury Hills No. 2 and A.A.O. Hospital Hill No. 4 is now to be supplemented by the addition of a gas supply to the Roma Hospital and oil from the Richmond field has been delivered to the Roma Power Station on a test basis.

It is also planned to construct an additional power station in the area to augment and extend the local power supply. A pipeline is proposed from the Bony Creek-Richmond fields for this purpose.

Although the Associated Group therefore, is confident that sufficient gas reserves exist to justify this development, further drilling and the obtainment of production test and reservoir data will be necessary before it will be possible to make an accurate assessment of the recoverable reserves of gas and oil in the structures at Bony Creek and Richmond in the Roma area, and at Rolleston.

Furthermore, it would appear on present indications, that additional productive structures must be discovered in the area before sufficient long term potential becomes available to attract industry on a sizeable scale, or to make a pipeline to existing industrial and marketing centres an economic proposition.

Although results have not been up to expectations, a new record was set up in both the number of wells drilled and the total footage drilled and this increased activity is still being maintained in the first few months of 1964.

A summary of drilling statistics is tabulated below and shows a total of 106 wells completed during the year, of which 70 were exploration or appraisal wells, 7 were development wells in the Moonie Field and 29 were scout bores.

Footage similarly was much higher than for 1962 with a total of 393,847 ft. drilled in exploration/appraisal drilling as compared with 177,248 ft. drilled in this type of well in 1962, in which year only 30 such wells were drilled to completion.

SUMMARY OF DRILLING ACTIVITIES—1963

Class of Well	Completed Wells						Uncompleted at 31-12-63			Total All Wells	Total Footage
	Oil Producer	Gas Producer	Water Wells	Injection Wells	Dry Holes	Total	Drilling	Testing	Suspended		
Exploration	1	2	8	..	43	54	3	..	3	60	307,702
Appraisal	1	6	..	..	9	16	2	1	1	20	86,145
Development	5	..	..	2	..	7	..	..	..	7	37,691
Scout	..	..	..	..	29	29	1	..	..	30	8,697
Totals	7	8	8	2	81	106	6	1	4	117	440,235

It will be noted from the above that a new classification for wells drilled in the search for petroleum has been introduced. The discovery of petroleum in commercial quantities in the State has necessitated a review and re-classification of oil wells and the following definitions have been adopted:—

1. *Exploration Well.*—A well being drilled with the object of discovering a new oil or gas reservoir or for the purpose of obtaining stratigraphical information which may assist in the discovery of a new oil or gas reservoir.
2. *Appraisal Well.*—A well being drilled to further define the extent of an already discovered oil or gas reservoir.
3. *Development Well.*—A well being drilled within the known limits or boundary of an already proven reservoir for the purpose of producing the oil or gas reserves in that reservoir.
4. *Scout Well.*—A well drilled for structural or stratigraphical information to shallow depths and consequently one in which normal geological and engineering requirements may be relaxed.

Exploration expenditure for the year reflected the increased activity mainly in seismic operations and drilling with a total of £8,940,000 as compared to a forecast expenditure of £9,600,000 and an actual expenditure for 1962 of £7,300,000.

Of the total expenditure of nearly £9,000,000 for 1963, the Commonwealth Government contributed £1,800,000 by way of subsidy.

A slight decline in activity is foreseen for 1964 unless significant new discoveries are soon found and forecast expenditure on exploratory work for such year is estimated at £8,250,000.*

In the Moonie Field, development drilling continued with the completion of 5 more producing wells and 2 observation/injection wells.

A total of 12 single completions and 3 dual completions were therefore made available for initial production from the field with an expenditure during 1963 of £420,000 on development drilling and a tentative estimate of £100,000 for repair/recompletion work on field wells during 1964.

Field production facilities and the 190 mile 10 inch pipeline to Brisbane were also completed successfully during the year.

* Despite the overall decline foreseen for the year, activity up to the time of writing (end of April 1964) has remained at an alltime high, nine strings being engaged simultaneously on exploration drilling within the State, with over 40 wells completed since the beginning of the year (exploration and appraisal).

The initial decision to construct these facilities was taken in January 1963 after the completion of a pipeline feasibility study, and on May 30th, 1963, Pipeline Licence No. 1 was issued to the newly formed Moonie Pipeline Company for the construction and operation of a pipeline from Moonie to the Fort Lytton Terminal in Brisbane.

Pipe laying commenced from Moonie on June 17th, and the final tie-in weld was made at Fort Lytton 115 days later on October 9th. Hydrostatic testing of various sections of the line was being carried out at the end of the year, while the Production Station at Moonie was also on the point of completion.

Total expenditure on this production station at Moonie and on the pipeline itself will amount to some £5 million, including expenditure on the Fort Lytton terminal facilities.

The Moonie Production Station is fully automated and of the latest design with a 5,000 bbls. capacity Slops Tank and a 500 bbls. capacity Surge Tank fed from a separator battery of 2 BS & B. horizontal 3 phase 3,000 bbls/day test separators and 1 BS & B. horizontal 3 phase bulk separator of 13,000 bbls/day capacity.

Clean oil from this installation is pumped through a LACT positive displacement metering system to the Moonie Pipeline Company's 43,000 bbl. capacity tank at the head of the pipeline.

Total throughputs of oil, water and gas are automatically metered at various stages through the station and such data as individual well gauges and daily field production are automatically transmitted by teleprinter to the Union Oil Company head office in Toowoomba.

From the 43,000 bbl. pipeline tank oil is picked up by two dual-fuel diesel driven mainline centrifugal pumps rated in series at 1,100 bbls./hour which deliver the oil to the 10-in. pipeline.

At Fort Lytton, the oil is received in one of two 140,000 bbl. capacity floating roof tanks from whence it can be pumped to a tanker at a rate of 10,000 bbls/hour. The Fort Lytton terminal installation also consists of a 50,000 bbl. ballast tank, an oil-water air flotation separator and skimming pits.

With regard to exploration surveys, it is notable that geophysical surveys which generally have shown a very marked increase over the years 1960-1962 (see figure 2) show an abrupt decline for the year 1963 in the case of aeromagnetics, and a levelling off in the case of seismic surveys. Geological surveys have remained at a fairly even level for the past few years, and it is encouraging to see an impressive increase in gravity work, although this still stands at a relatively low level.

The levelling off of seismic work, is a disturbing trend. The recent encouraging discoveries in the State have undoubtedly been due to leads resulting from geophysical surveys in general, and seismic work in particular. Without these surveys, the location of suitable drilling objectives in this country will be rendered difficult with a consequent reduction in the chances of drilling successful exploration wells.

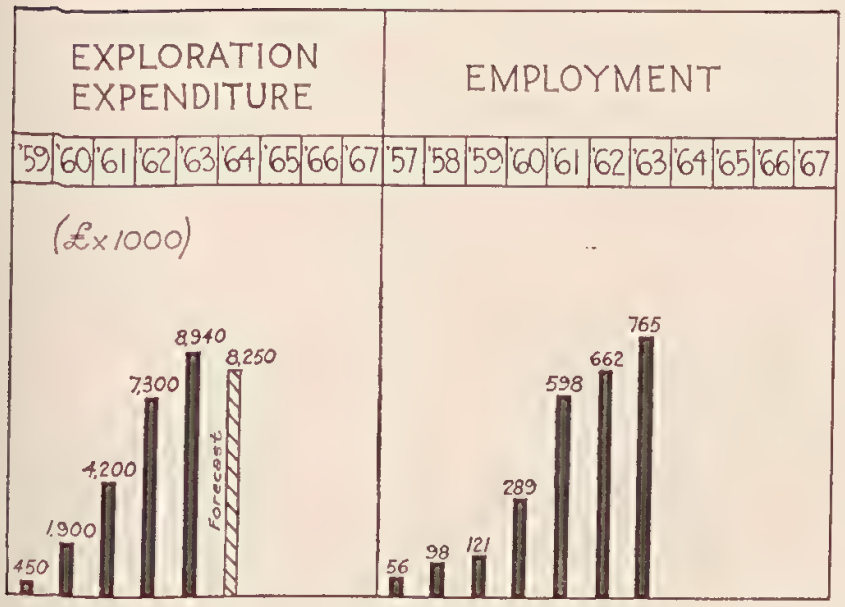
FOOTNOTE.—Continuous production from the Moonie field commenced in February, 1964, and after completion of all hydrostatic tests of the pipeline, the first oil entered the line on 4th March, arriving at Fort Lytton on 28th March.

The first shipment of oil is expected to leave Fort Lytton for Sydney in May, 1964.

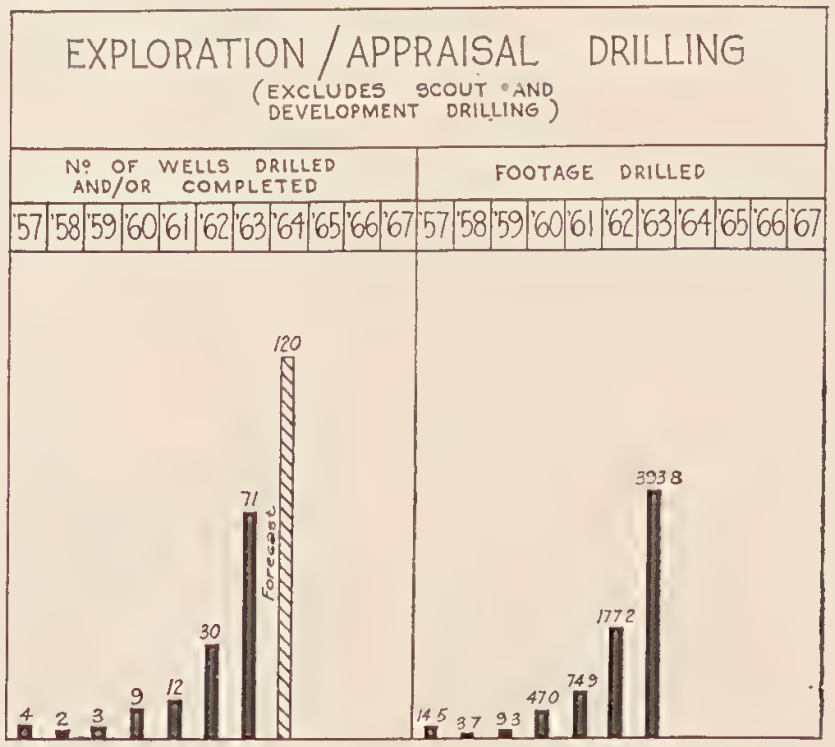
FIGURE 5

GRAPHS ILLUSTRATING PROGRESS IN OIL EXPLORATION IN QUEENSLAND

GRAPH 'A'



GRAPH 'B'



GRAPH 'A' shows the increase in expenditure and total employment since figures were first compiled (1959 & 1957 respectivly.)

GRAPH 'B' illustrates the sharp increase in exploration drilling since the Moonie discovery in 1961.

S. G. REID, Government Printer, Brisbane

QUEENSLAND
DEPARTMENT OF MINES

Fifth Supplement to
Geological Survey Publication No. 299
"OCCURRENCE OF PETROLEUM AND NATURAL GAS IN QUEENSLAND"
1961

PETROLEUM EXPLORATION IN QUEENSLAND DURING 1964

BRISBANE
By Authority: S. G. REID, Government Printer
1966

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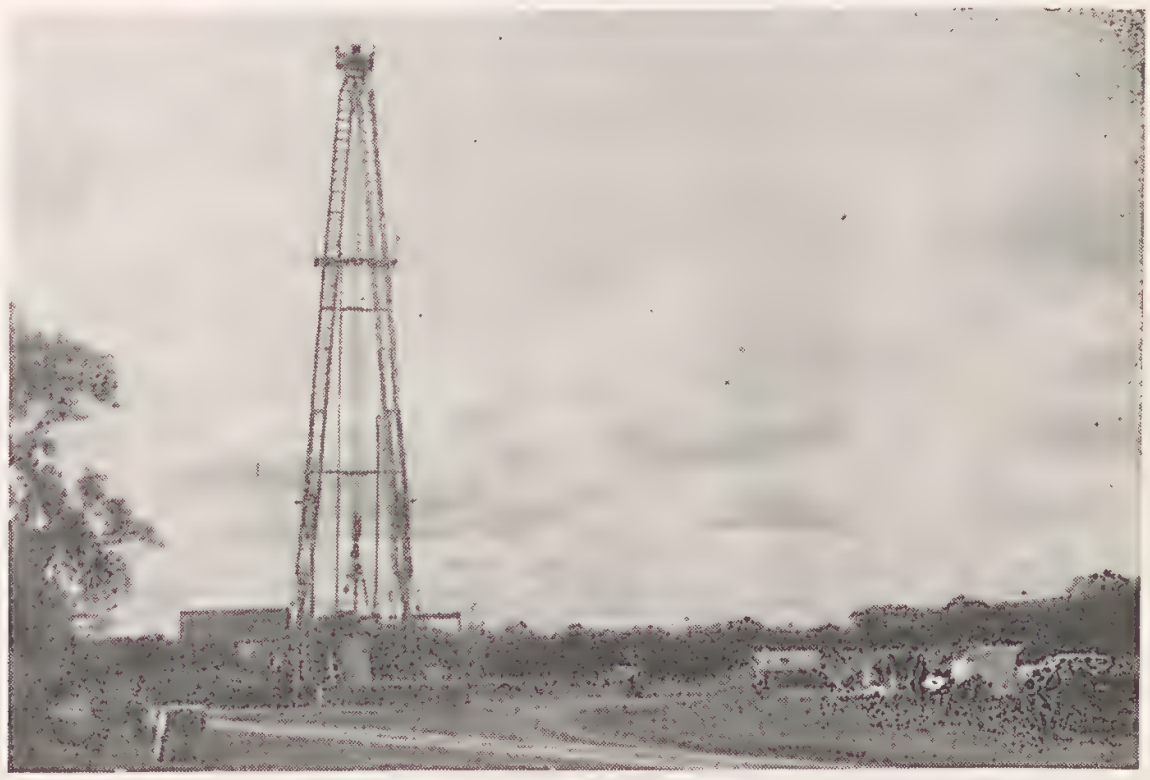
PREFACE

Publication No. 299 of the Geological Survey of Queensland—"Occurrence of Petroleum and Natural Gas in Queensland"—dealt with the search for petroleum in Queensland to the end of 1959. To keep this publication up to date, it was decided to issue as a supplement each year, a reprint of the section of the Annual Report of the Department of Mines relating to petroleum exploration. This reprint is the fifth supplement.

The supplement was prepared by officers of the State Mining Engineer's Branch and of the Petroleum Section, Geological Survey of Queensland.

Calibrating prover tank,
LACT unit,
Moonie Oilfield.



National Ideal 55 Rig
(O.D. & E.) at Amoseas
Boree, No. 1 Location.

Marathon Glenhaugton
No. 1 Well.

PETROLEUM EXPLORATION AND PRODUCTION

1. **Exploration**

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4. **Legislation**

5. **Pipelines**

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1. EXPLORATION

1–1 Exploration General

The year 1964 will undoubtedly be remembered as the year in which Australia's first oilfield at Moonie 200 miles west of Brisbane went into production. Ceremonies marking the occasion were held at the oilfield on 25th March, when the production station was officially opened by the then Minister for Mines, the Hon. E. Evans, M.L.A., and again at Lytton on 8th April when the Premier of Queensland, the Hon. G. F. R. Nicklin, M.M., M.L.A., opened a valve to bring oil from the Moonie oilfield to Brisbane, through the Moonie Pipeline. The first tanker load of local crude oil left Brisbane on 25th May bound for southern refineries.

The commencement of production of indigenous crude oil, was however somewhat clouded by the inability of the producer to obtain a price satisfactory to him from local refiners, in competition with imported crude (imported chiefly from Indonesia, Borneo and the Middle East, the existing sources of supply). A temporary solution was arrived at after consultations between all parties concerned and the Minister for National Development. As a result of this price dispute, the Tariff Board was instructed by the Commonwealth Government to conduct an enquiry into the matter, and to report on the same by 31st July, 1965.

Other highlights of the year include the discovery also by Union Oil, of the Alton field, some 60 miles south-west of Moonie. This field although small, will no doubt be brought into production in 1965 through the Moonie to Brisbane pipeline. A further oil discovery was made at Conloi, some 95 miles north of Moonie (between Miles and Wondoan). The productive zone here is however very thin and the well appears capable of producing only on the pump (see Table 2–3).

A gas discovery of considerable importance has resulted from the drilling of a deep exploration well in the Adavale Basin some 120 miles north-west of Charleville, where a well being drilled by Phillips Petroleum Company encountered Devonian gas below 11,900 feet. It is early yet to attempt to assess the extent of this discovery, and appraisal drilling will be necessary to evaluate it, there is no question however, as to its significance, since an entirely new horizon has been opened up for investigation by the disclosure of prospects in the deeper parts of the Great Artesian Basin.

In spite of extremely vigorous efforts by the Associated Group, very little additional production has been gained. As will be seen from Table 1–4, the Group through its operating company (Mines Administration Pty. Ltd.) drilled more than one-third of the exploration wells, and more than two-thirds of the appraisal wells drilled in the State. Their total of 85 wells drilled, is in fact, considerably more than half of the total of 156 wells completed during the year by all operators. As a result of this activity in addition to final appraisal of the Bony Creek/Richmond fields, a number of small gas fields, notably Arcturus, Beaufort, Blyth Creek, Raslie, Yanalah and Lamen, has been added to those established previously.

In addition, Amalgamated Petroleum Exploration Pty. Ltd., in their farmouts from the Associated Group in the Roma area, has discovered two rather limited gas fields at Back Creek and Snake Creek.

Steps were taken during the year towards exploitation of the Roma gas discoveries, discussions being held between the Associated Group and potential consumers in Brisbane. The Group's officers also commenced the investigation of possible pipeline routes between Roma and Brisbane.

With the commencement of production in the State, a start has been made in this report, with the publication of the State's oil and gas reserves, production, and utilisation. It must be realised that reserve estimates can never be exact and are subject to constant revision with exploitation, as more reservoir data becomes available, not only through testing operations, but also as production proceeds.

Reserve estimates of Queensland's oil and gas fields are given in Tables 2–1 and 2–2. These estimates were made on the known fields as at 31st December, 1964 and are based upon the information then available. Since this time, extensive testing of the larger fields has been undertaken and revision and up dating of the reserve estimates will follow as additional data comes to hand.

Of increasing importance to the pastoral industry is the number of abandoned oil wells being converted to water wells. With the co-operation of the industry, a growing number of such wells is being handed over to graziers, the actual conversion operations being controlled by this Department in close co-operation with the Irrigation and Water Supply Commission. In 1964 nineteen such conversions took place.

In some respects, the year has been a disappointing one as will be seen from figures 1–1, 1–2 and 1–3. Total expenditure has remained practically static over the years 1963 and 1964, while on exploration alone, expenditure has fallen slightly. Employment figures show an increase, while an increase of well over 100 per cent. took place in the total number of wells drilled. Appraisal, drilling in particular, due chiefly to efforts made by the Associated Group to assess the extent of their gas discoveries in the Roma district, showed an increase which almost quadrupled the 1963 figures. As a result of this vast increase in drilling activity, the total number of drilling strings operating in the State rose to a maximum of 14.

A noteworthy feature of 1964 exploration activities lies in the interest being displayed on offshore operations, marine seismic surveys being carried out on three separate continental shelf titles.

A very disquieting trend is apparent however, in exploration surveys, all of which decreased compared with the previous year. In particular the drastic falling off of seismic surveys is disturbing. Fortunately it appears that this trend will be arrested in 1965, since it appears from discussions with operators that a 50 per cent. increase in exploration expenditure, chiefly in seismic surveys, can be anticipated. Estimated total exploration expenditure in 1965 is in the region of £11 million with appraisal/development (chiefly drilling) an additional £1¼ million. Well over half the total of £12¼ million is expected to be spent by two operators, Phillips Petroleum Company, and Union Oil Development Corporation.

A very note-worthy event which took place in 1964 was the decision of the Queensland Government to seek the advice of an overseas expert regarding the best use to be made of the energy resources of the State. As a result of this decision, the firm of Charles R. Hetherington and Co. of Calgary, Alberta, was retained to undertake the assignment. Dr. Hetherington visited Queensland in August and September, and his report entitled "The Energy Resources of Queensland and Their Use" was completed and presented to the Government at the end of the year, and published by the Government Printer in January, 1965.

GRAPHS ILLUSTRATING PROGRESS IN OIL EXPLORATION IN QUEENSLAND

FIG. 1–1

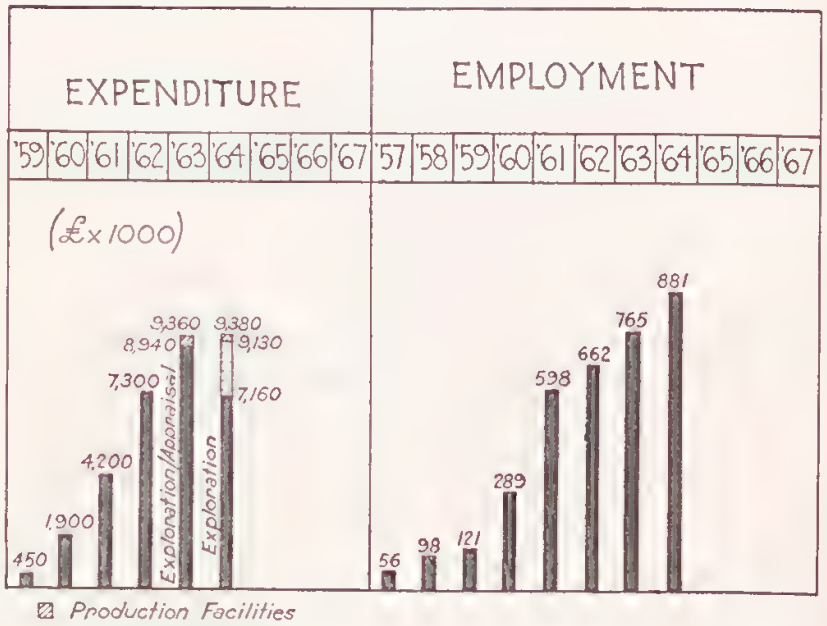


FIG. 1–2

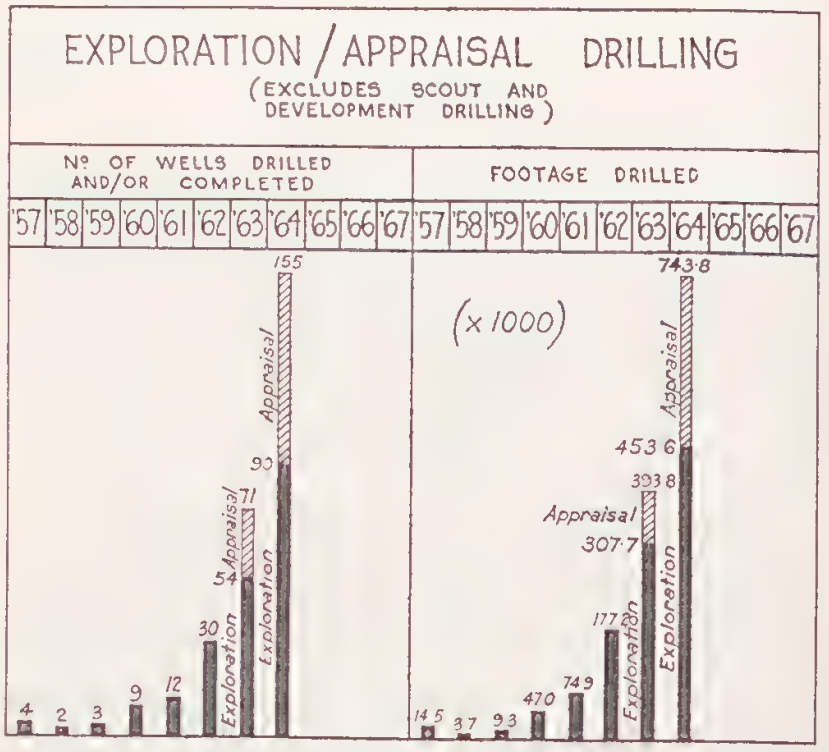


Fig. 1-1 shows the increase in expenditure and total employment since figures were first compiled (1959 & 1957 respectively.)

Fig. 1-2 illustrates the sharp increase in exploration drilling since the Moonie discovery in 1961.

FIGURE 1-3

GEOPHYSICAL SURVEYS

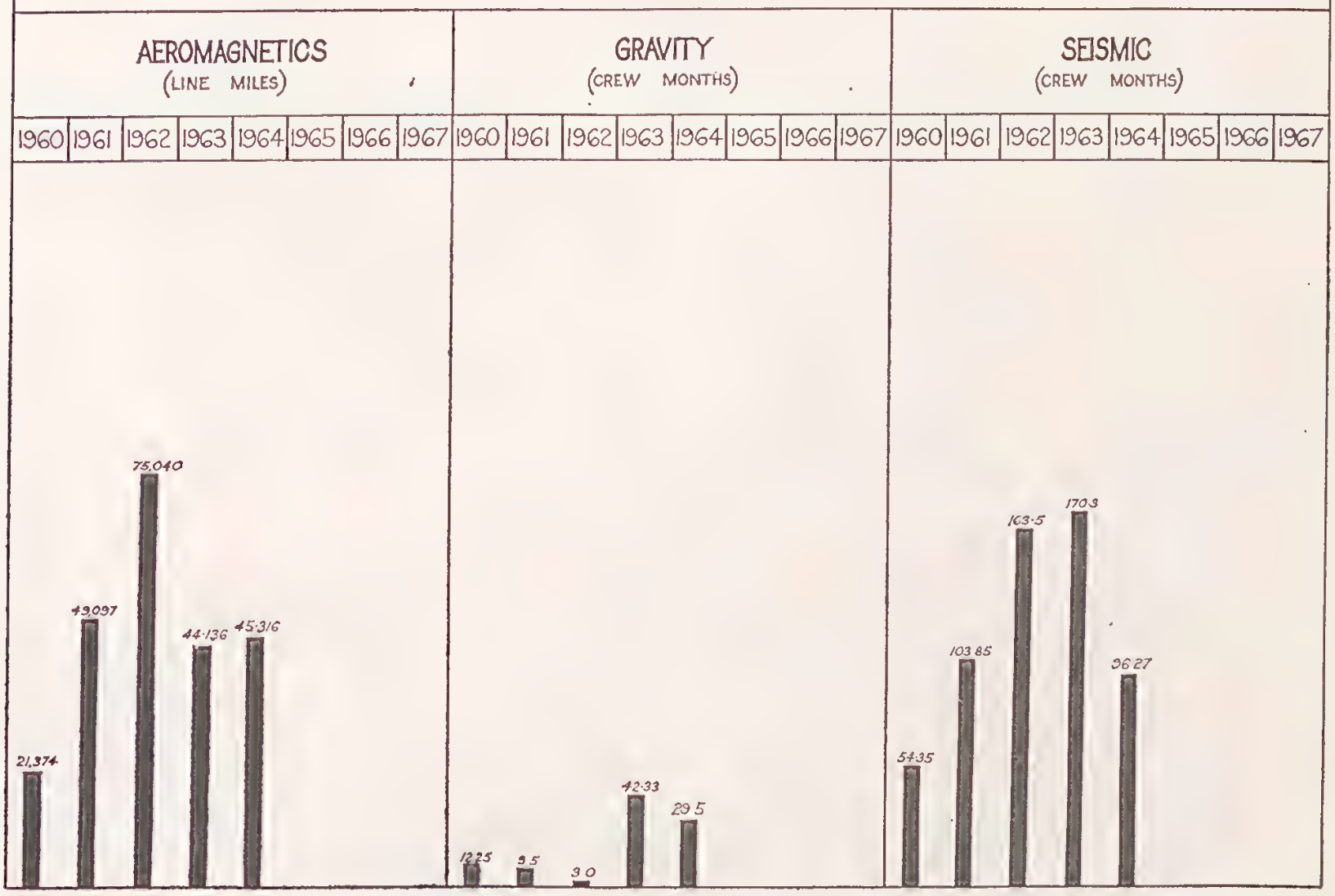


TABLE 1–1

SUMMARY OF DRILLING ACTIVITIES, 1964

Class of Well	Completed					Uncompleted at 31st December, 1964			Total All Wells	Footages Drilled
	Oil Producers	Gas Producers	Water Wells	Abandoned	Total	Awaiting Completion or Drilling	Testing	Suspended		
Exploration ..	2	10	16	62	90	4	..	3	97	453,626
Appraisal ..	6	22	3	34	65	1	..	1	67	284,363
Development ..	..	..	..	..	..	1	..	..	1	5,827
Totals ..	8	32	19	96	155	6	..	4	165	743,816

1–2 Titles

Figure 1–4 shows the location of prospecting titles as at 31st December, 1964, also the single Petroleum Lease at Moonie, and the Pipeline License extending from Moonie to Brisbane.

On 31st December, 1963, 728,586 square miles were held under 34 Authorities to Prospect for Petroleum. The average size of each was approximately 21,000 square miles. As at 31st December, 1964, 592,765 square miles were held under 32 Authorities to Prospect for Petroleum, the average size of each being 18,500 square miles. It will be seen, therefore, that gradually, the size of these titles is reducing, due as is quite evident, to the increasing amount of vacant acreage resulting from compulsory surrenders.

It will, however, be some time before areas of real interest to prospectors become available through surrenders. Applications were invited early in 1964 for Authorities to Prospect over a number of surrendered and consequently vacant areas. As anticipated however, little interest was displayed and it is an indication of the calibre of the present day operators that speculation in these non-prospective areas has not taken place.

Table 1–2 lists among other data, titleholders and operators for each exploration title held in the State. Due to the absence of prospective vacant areas, many explorers are finding farm-ins the only way open to them of gaining access to oil exploration in the State. Such arrangements are becoming more in evidence as time goes by.

FIGURE 1-4

Prepared at the Department of Mines Brisbane.
QUEENSLAND
Showing
APPROXIMATE AREAS COVERED BY AUTHORITIES TO PROSPECT AND PROSPECTING PETROLEUM PERMITS
AS AT 31 ST. DEC. 1964.
SCALE OF MILES
100 50 0 100 200 300
Railways Shown
104P
88P
Area A
Do
58P
95P
25 acres Excluded Area (Z.C.I. Weipa Well No 1)
Weipa
88P
Area B
61P
Area A
61P
Area B
Cooktown
Cairns
Normanton
91P
Croydon
Forsayth
79P
Area A
79P
Area C
Townsville
Charters Towers
90P
96P
Mt Isa
Cloncurry
Hughenden
79P
Area B
76P
Mackay
103P
Winton
Mittabarra
105P
Clermont
St Lawrence
56P
Boulia
54P
86P
Longreach
87P
102P
Alpha
75P
Rockhampton
Springsure
89P
Issford
83P
Blackall
81P
Rolleston
100P
Area A
97P
Area C
Jundah
Yaraka
Tambo
100P
Area B
Theodore
97P
Area B
70P
Bundaberg
66P
67P
98P
84P
101P
55P
Taroom
97P
Area A
Mundubbera
Maryborough
99P
Charleville
Eromanga
Quilpie
Roma
Miles
PPP708
Gympie
72P
Surat
57P
Tara
71P
PPP715
PETROLEUM LEASE No 1
Toowoomba
Moonie
PIPELINE LICENSE No 1
BRISBANE
Cunnamulla
St George
Alton
Dirranbandi
137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155

TABLE 1–2

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
Alliance Oil Development Australia N.L., H. B. Borwick, Managing Director, 5th Floor, 100 Collins Street, Melbourne; L. W. Doggett, Agent, Box 281D, G.P.O., Brisbane; P. W. Rainier (Exploration Manager)	Planet Exploration Company Ltd. (Richter Bawden Drilling Pty. Ltd.)	81P	14,610	Alpha	Gravity Seismic	1 1	Planet Crystalbrook No. 1	63 miles N. of Mitchell	2,060	2,060	Completed as a water well	Alliance Petroleum Australia N.L. have 25% interest in 81P. In the south-east of the title a farmout agreement is in force with Planet Exploration Company Ltd., Managing Director J. G. Fuller, 26 O'Connell Street, Sydney
							Planet Tooloombilla No. 1	45 miles N. of Mitchell	1,750	1,750	Plugged as a dry hole	
							Planet Warrong No. 1	65 miles N.W. of Injune	3,573	3,573	Plugged as a dry hole	
Amalgamated Petroleum Exploration Pty. Ltd., A. R. Dodson, Executive Director, Box 4721, G.P.O., Melbourne; Dr. T. B. Haites, Exploration Manager, Scottish Union House, 127 Eagle Street, Brisbane	Titleholder	79P Area A	3,488	Mount Isa								
		79P Area B	1,479	Mount Isa								
		79P Area C	5,073	Cloncurry				No Drilling Activity				
		97P Area A	210	Cracow								
		97P Area B	730	Monto	Geological	2·5		No Drilling Activity				
		97P Area C	2,390	Biggenden								
Amerada Petroleum Corporation of Australia Ltd.	Marathon Petroleum Australia; Titleholder from 1–9–64	75P	5,600	West of Longreach	Seismic	3·6		No Drilling Activity				Continental Oil Company of Australia Ltd. withdrew December, 31st, 1963. Marathon Petroleum withdrew August 31st, 1964
Amerada Petroleum Corporation of Australia Ltd., Marathon Petroleum Australia Ltd. (Equal Shares)	Marathon Petroleum Australia; C. R. Loose, Western Hemisphere Manager, 539 South Main Street, Findlay, Ohio, U.S.A.; W. E. Swales, Exploration Manager, Box 687K, G.P.O., Brisbane	83P	9,300	Isisford	Seismic	4·2		No Drilling Activity				Continental Oil Company of Australia Ltd. withdrew December 31st, 1963
Ampol Exploration (Q'land) Pty. Ltd., W. G. Walkley, Managing Director; S. Nasr, Exploration Manager, Buchanan Street, Balmain, N.S.W.	Titleholder	103P	8,007	Mackay	Geological Seismic (Marine)	7 0·33		No Drilling Activity				
Associated Australian Oilfields N.L., E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Exploration Director, Box 880L, G.P.O., Brisbane	Mines Administration Pty. Ltd. except Western part of Title, Australian Aquitaine Petroleum Pty. Ltd., G. Rutman, Director General, S.N.P.A., Box 82, Pau, France (Richter Bawden Drilling Pty. Ltd., Forasol S.A.)	86P	9,300	West of Longreach			A.A.O. Beryl No. 1	100 miles N.N.W. of Longreach	4,154	4,154	Plugged as a dry hole	In areas 54P, 55P, 56P, 61P, 86P and 89P Associated Australian Oilfields N.L., Associated Freney Oilfields N.L., The Papuan Apinaipi Petroleum Company Ltd., Associated Continental Petroleum N.L., Interstate Oil Ltd. and Sleigh Exploration No Liability are jointly associated. In respect of Western part of 86P, Australian Aquitaine is earning an interest
							A.A.P. Fermoy No. 1	80 miles W.N.W. of Longreach	5,262	5,262	Plugged as a dry hole	
							A.A.P. Mayneside No. 1	110 miles W. of Longreach	5,382	5,382	Plugged as a dry hole	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
Associated Australian Oilfields N.L., E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne; D. M. Traves, Exploration Director, Box 880L, G.P.O., Brisbane	Mines Administration Pty. Ltd.	61P Area A	10,200	Laura Basin				No Drilling Activity				Title transferred from Marathon Petroleum Australia Limited to Associated Australian Oilfields N.L. with effect from 24–3–64
		Area B	5,003	Coleman River				No Drilling Activity				
Associated Australian Oilfields N.L.; Associated Freney Oilfields N.L.; Papuan Apinaipi Petroleum Co. Ltd.	Until 28th July, 1964, Marathon Petroleum (Australia) Ltd. (Richter Bawden Drilling Pty. Ltd.)	89P	7,816	Baralaba–Duaringa			Marathon–Continental Glenhaughton No. 1	53 miles N.W. of Taroom	1,458	9,418	Plugged as a dry hole	Title to 89P was assigned to Associated Australian Oilfields N.L. *et al* on 28th July, 1964, from Marathon Petroleum (Australia) Ltd. and Continental Oil Coy. of Australia
Associated Australian Oilfields N.L. and Associated Freney Oilfields N.L., E. N. Avery, Chairman and Managing Director, 360 Collins Street, Melbourne, D. M. Traves, Exploration Director, Box 880L, G.P.O., Brisbane	Mines Administration Pty. Ltd. (Richter Bawden Drilling Pty. Ltd.)	55P	Combined area 55/56P, 31,633 subject to a surrender of about 4,000 square miles	Roma–Theodore	Seismic	16·75	A.A.O. Beaufort No. 1	7 miles E. of Roma	3,836	3,836	Completed as a gas producer	Titles 55P and 56P are amalgamated. Two areas to the south-east and south of Roma known as the Combargno and Yalebone areas are subject to an agreement with Amalgamated Petroleum Exploration Pty. Ltd., who are operators of the same and who have earned a 50% interest in the Combargno area
							A.A.O. Beaufort No. 2	8 miles E. of Roma	3,845	3,845	Cased as a potential gas producer	
							A.A.O. Beaufort No. 3	6·5 miles E. of Roma	3,820	3,820	Cased as a potential gas producer	
							A.A.O. Beaufort No. 4	6·5 miles E. of Roma	3,856	3,856	Plugged as a dry hole	
							A.A.O. Belbri No. 1	14 miles N.E. of Roma	3,500	3,500	Completed as a water well	
							A.A.O. Bella Farm No. 1	7½ miles E.S.E. of Roma	3,911	3,911	Plugged as a dry hole	
							A.A.O. Bindaroo No. 1	15 miles E.S.E. of Roma	4,460	4,460	Plugged as a dry hole	
							A.A.O. Binya No. 1	18 miles S.W. of Roma	4,318	4,318	Plugged as a dry hole	
							A.A.O. Blyth Creek No. 1	11 miles E.S.E. of Roma	3,998	3,998	Cased as a potential gas producer	
							A.A.O. Blyth Creek No. 2	11 miles E.S.E. of Roma	3,975	3,975	Cased as a potential gas producer	
							A.A.O. Blyth Creek No. 3	10 miles E.S.E. of Roma	3,888	3,888	Plugged as a dry hole	
							A.A.O. Blyth Creek No. 4	10 miles E.S.E. of Roma	3,880	3,880	Plugged as a dry hole	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							A.A.O. Blyth Creek No. 5	10·5 miles E.S.E. of Roma	3,933	3,933	Plugged as a dry hole	
							A.A.O. Blyth Creek No. 6	11 miles E.S.E. of Roma	4,042	4,042	Plugged as a dry hole	
							A.A.O. Blyth Creek No. 7	11·5 miles E.S.E. of Roma	3,975	3,975	Plugged as a dry hole	
							A.A.O. Blythewood No. 1	12 miles S.S.E. of Roma	4,320	4,320	Plugged as a dry hole	
							A.A.O. Bony Creek No. 7		Nil	4,711	Plugged as a dry hole	Rig released 2–1–64
							A.A.O. Bony Creek No. 8		4,422	4,422	Completed as a water well	
							A.A.O. Bony Creek No. 9		4,546	4,546	Cased as a potential gas producer	
							A.A.O. Bony Creek No. 10	Bony Creek Gas Field 16 miles S.E. of Roma	4,444	4,444	Completed as a gas producer	
							A.A.O. Bony Creek No. 11		4,520	4,520	Plugged as a dry hole	
							A.A.O. Bony Creek No. 12		4,485	4,485	Completed as a gas producer	
							A.A.O. Bony Creek No. 13		4,360	4,360	Completed as a gas producer	
							A.A.O. Bony Creek No. 14		4,624	4,624	Plugged as a dry hole	
							A.A.O. Boondara No. 1	30 miles S.E. of Roma	5,859	5,859	Completed as a water well	
							A.A.O. Bore View No. 1	18 miles E.N.E. of Roma	4,960	4,960	Completed as a water well	
							A.A.O. Buckenan Downs No. 1	3 miles S. of Roma	2,960	..	Drilling	
							A.A.O. Bungil No. 1	6 miles S.S.E. of Roma	4,103	4,103	Completed as a water well	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							A.A.O. Coolibah No. 1	6 miles S. of Roma	4,313	4,313	Plugged as a dry hole	
							A.A.O. Coolibah East No. 1	3 miles S.S.E. of Roma	4,300	4,300	Plugged as a dry hole	
							A.A.O. Dalmuir No. 1	20 miles N.E. of Roma	4,367	4,367	Plugged as a dry hole	
							A.A.O. Dirinda No. 1	11 miles S.W. of Roma	4,296	4,296	Plugged as a dry hole	
							A.A.O. Duarran No. 1	8 miles S. of Roma	4,315	4,315	Plugged as a dry hole	
							A.A.O. Kalima No. 1	33 miles N. of Roma	2,173	2,173	Completed as a water well	
							A.A.O. Lamen No. 1	13 miles E.S.E. of Roma	4,074	4,074	Cased as a potential gas producer	
							A.A.O. Lamen No. 2	12 miles E.S.E. of Roma	4,050	4,050	Completed as a water well	
							A.A.O. Latemore East No. 2	19 miles E. of Roma	4,751	4,751	Plugged as a dry hole	
							A.A.O. Mount Hope No. 1	22 miles N.E. of Roma	2,562	2,562	Plugged as a dry hole	
							A.A.O. Pickanjinnie No. 3	21 miles E. of Roma	4,593	4,593	Completed as a gas producer	
							A.A.O. Pickanjinnie No. 4	20 miles E. of Roma	4,590	4,590	Completed as a gas producer	
							A.A.O. Pickanjinnie No. 5	19·5 miles E. of Roma	4,738	4,738	Plugged as a dry hole	
							A.A.O. Pickanjinnie No. 6	22 miles E. of Roma	4,651	4,651	Completed as a gas producer	
							A.A.O. Pickanjinnie No. 7	21·5 miles E. of Roma	4,825	4,825	Plugged as a dry hole	
							A.A.O. Pickanjinnie No. 8	21·5 miles E. of Roma	4,803	4,803	Completed as a gas producer	
							A.A.O. Quibet No. 1	9 miles N.N.E. of Roma	3,555	3,555	Completed as a water well	
							A.A.O. Raslie No. 1	18 miles E.N.E. of Roma	4,387	4,387	Completed as a gas producer	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							A.A.O. Raslie No. 2	18·5 miles E.N.E. of Roma	4,120	4,120	Plugged as a dry hole	
							A.A.O. Raslie No. 3	17·5 miles N.E. of Roma	4,101	4,101	Plugged as a dry hole	
							A.A.O. Richmond No. 9	Richmond Gas Field 9 miles S.S.E. of Roma	4,031	4,456	Plugged as a dry hole	
							A.A.O. Richmond No. 10		4,272	4,272	Completed as an oil producer	Programmed for recompletion as a gas well
							A.A.O. Richmond No. 11		4,270	4,270	Completed as a gas producer	
							A.A.O. Richmond No. 12		4,370	4,370	Plugged as a dry hole	
							A.A.O. Richmond No. 13		4,342	4,342	Completed as a gas producer	
							A.A.O. Richmond No. 14		4,289	4,289	Plugged as a dry hole	
							A.A.O. Richmond No. 15		4,221	4,221	Plugged as a dry hole	
							A.A.O. Richmond No. 16		4,200	4,200	Completed as a gas producer	
							A.A.O. Richmond No. 17		4,130	4,130	Plugged as a dry hole	
							A.A.O. Richmond No. 18		4,165	4,165	Completed as a gas producer	
							A.A.O. Richmond No. 19		4,220	4,220	Plugged as a dry hole	
							A.A.O. Richmond No. 20		4,165	4,165	Plugged as a dry hole	
							A.A.O. Richmond No. 21		4,108	4,108	Plugged as a dry hole	
							A.A.O. Richmond No. 22		4,136	4,136	Plugged as a dry hole	
							A.A.O. Richmond No. 23		4,104	4,104	Plugged as a dry hole	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							A.A.O. Sawpit Creek No. 1	23 miles N.E. of Roma	3,753	3,753	Plugged as a dry hole	
							A.A.O. Sleepy Creek No. 1	12 miles N.E. of Roma	3,392	3,392	Completed as a water well	
							A.A.O. Sunnybank No. 5	37 miles S.E. of Roma	6,500	6,500	Plugged as a dry hole	
							A.A.O. Tineen No. 1	4 miles N.W. of Roma	3,680	3,680	Plugged as a dry hole	
							A.A.O. Warooby South No. 1	85 miles E. of Roma	3,890	3,890	Plugged as a dry hole	
							A.A.O. Wattanooka No. 1	15 miles E. of Roma	4,505	4,505	Plugged as a dry hole	
							A.A.O. Wyena No. 1	23 miles N.E. of Roma	3,713	3,713	Plugged as a dry hole	
							A.A.O. Yanalah No. 1	5·5 miles N.E. of Roma	4,136	4,136	Completed as a gas producer	
							A.A.O. Yanalah No. 2	5 miles N.E. of Roma	3,833	3,833	Plugged as a dry hole	
							A.A.O. Yanalah No. 3	5 miles N.E. of Roma	4,050	4,050	Cased as a potential gas producer	
Amalgamated Petroleum Exploration Pty. Ltd., A. R. Dodson, Executive Director, Box 4721, G.P.O., Melbourne; Dr. T. B. Haites, Exploration Manager, Scottish Union House, 127 Eagle Street, Brisbane (Richter Bawden Drilling Pty. Ltd.)		55P		Roma–Theodore			A.P. Back Creek No. 1	24 miles S.E. of Roma	5,295	5,295	Cased as a potential gas producer	Amalgamated Petroleum Exploration Pty. Ltd. have earned a 50% interest in the Combarngo farmout with Associated Australian Oilfields No Liability, and are operating under the terms of a farmout agreement in the Yalebone area (see above)
							A. P. Back Creek No. 2	26 miles S.E. of Roma	5,055	5,055	Cased as a potential gas producer	
							A.P. Back Creek No. 3	26 miles S.E. of Roma	4,976	4,976	Plugged as a dry hole	
							A.P. Back Creek No. 4	26 miles S.E. of Roma	5,006	5,006	Plugged as a dry hole	
							A.P. Back Creek No. 5	26 miles S.E. of Roma	5,020	5,020	Plugged as a dry hole	
							A.P. Duncan Creek No. 1	20 miles S. of Roma	2,247		Drilling	
							A.P. Snake Creek No. 1	28 miles S.E. of Roma	5,270	5,270	Completed as a gas producer	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							A.P. Snake Creek No. 2	28 miles S.E. of Roma	5,178	5,178	Completed as a gas producer	
							A.P. Snake Creek No. 3	28 miles S.E. of Roma	5,253	5,253	Plugged as a dry hole	
							A.P. Snake Creek No. 4	28 miles S.E. of Roma	4,989	4,989	Completed as a gas producer	
							A.P. Wallabella No. 1	28 miles S.E. of Roma	6,350	6,350	Completed as a water well	
							A.P. Yalebone No. 1	20 miles S. of Roma	4,909	4,909	Completed as a water well	
Associated Australian Oilfields N.L. and Associated Freney Oilfields N.L., E. N. Avery, Chairman and Managing Director, Melbourne; D. M. Traves, Exploration Director, Box 880L, G.P.O., Brisbane	Mines Administration Pty. Ltd.	56P		Emerald–Nebo	Seismic	6·7	A.F.O. Arcturus No. 1	25 miles E. of Springsure	6,195	6,195	Completed as a gas producer	
							A.F.O. Arcturus No. 2	25 miles E. of Springsure	3,650	3,650	Completed as a water well	
							A.F.O. Arcturus No. 3	25 miles E. of Springsure	2,150	2,150	Cased as a potential gas producer	
							A.F.O. Arcturus No. 4	25 miles E. of Springsure	427		Drilling	
							A.F.O. Rolleston No. 1	Rolleston Gas Field 7 miles S. of Rolleston	1,669	9,508	Completed as a gas producer	
							A.F.O. Rolleston No. 2		1,049	4,732	Plugged as a dry hole	
							A.F.O. Rolleston No. 3		3,250	3,250	Cased as a potential gas producer	
							A.F.O. Rolleston No. 4		3,483	3,483	Plugged as a dry hole	
							A.F.O. Rolleston No. 5		3,634	3,634	Plugged as a dry hole	
							A.F.O. Rolleston No. 6		5,490	5,490	Plugged as a dry hole	
							A.F.O. Rolleston No. 7		3,500	3,500	Plugged as a dry hole	
							A.F.O. Rolleston No. 8		3,400	3,400	Cased as a potential gas well	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
	Amalgamated Petroleum Exploration Pty. Ltd. (Richter Bawden Drilling Pty. Ltd.)						A.P. Cometside No. 1	18 miles S.E. of Rolleston	5,562	5,562	Plugged as a dry hole	Amalgamated Petroleum Exploration Pty. Ltd. drilled 3 holes under the Purbrook Farmout Agreement with Associated Australian Oilfields No Liability. This agreement has now terminated
							A.P. Motley No. 1	16 miles S.E. of Rolleston	4,187	4,187	Plugged as a dry hole	
							A.P. Purbrook South No. 1	26¼ miles S.S.E. of Rolleston	5,582	5,582	Plugged as a dry hole	
Australian Aquitaine Petroleum Pty. Ltd., G. Rutman, Director General, S.N.P.A., Box 82, Pau, France; J. Payan, Director and Manager for Australia, Perry House, Elizabeth Street, Brisbane	Titleholder	95P	13,374	Cape York Peninsula	Aero-magnetic Geological	2·7 6	No Drilling Activity					
Australian Oil Corporation, N. J. Dowdle, President, T. B. Lacaff, Sr. Vice President and General Manager, Midland Savings Building, Midland, Texas, U.S.A.; D. G. Jones, Solicitor, Box 4943, G.P.O., Sydney	Titleholder	96P	7,242	Julia Creek	Gravity and Geological	3½	No Drilling Activity					
Australian Oil and Gas Corporation Ltd., T. H. W. Dee, Managing Director, Box 5048, G.P.O., Sydney	Australian Gulf Oil Company, T. C. Wilson, Exploration Representative, Box 832L, G.P.O., Brisbane	90P	57,000	Great Barrier Reef	Geological Aero-magnetic Aerial Photography	1 7 7	No Drilling Activity					This area is subject to an agreement with Australian Gulf Oil Company who are the present operators
Delhi Australian Petroleum Ltd. (50%) and Santos Limited (50%); Delhi, W. Clifford-Smith, President, Fidelity Union Tower, Dallas, Texas, U.S.A.; C. T. Easley, Resident Manager, Box 1837P, G.P.O., Adelaide, South Australia; Santos, J. E. Klug, Chief Executive Officer, Bennet and Fisher Building, 12 Currie Street, Adelaide, South Australia	Marathon Petroleum Australia Ltd.	58P	92,230	Gulf of Carpentaria	Aero-magnetic	3	No Drilling Activity					Marathon Petroleum Australia Ltd., operator will earn 1/3rd working interest on completion of work obligation
	Delhi Australia Petroleum Corporation	66/67P (Amalgamated)	67,600	Haddon Corner	Seismic	2						
	French Petroleum Company (Australia) Ltd., C. de Lapparent, General Manager, Bennet and Fisher Building, 12 Currie Street, Adelaide, S.A. (Forasol, S. A.)			Queensland-S. A. Border	Geological Gravity Seismic	3 10 10	F.P.C.A. Marduroo No. 1	80 miles S. of Boulia	3,861	3,861	Plugged as a dry hole	The area of 66/67P west of 141° East Longitude is now held Santos 25%, Delhi 25% and French Petroleum Coy. (Aust.) Pty. Ltd. 50%. The balance of the titles, east of 141° Longitude is held jointly by Santos and Delhi in equal shares
							F.P.C.A. The Brothers No. 1	120 miles S.S.W. of Boulia	4,173	4,173	Plugged as a dry hole	
Exoil No Liability (70%), Transoil No Liability (30%). C. W. Siller, Chairman, 1st and 3rd Floors, Perry House, Elizabeth Street, Brisbane; L. W. Doggett, Secretary, Box 281D, G.P.O., Brisbane	Titleholder (Oil Drilling and Exploration Ltd.)	76P	37,620	Hughenden			Exoil–Transoil Lake Galilee No. 1	70 miles N.E. of Aramac	11,175	11,175	Plugged as a dry hole	Small oil recovery in D.S.T.
Farmout Drillers No Liability, Longreach Oil Limited and Midwood Exploration Pty. Ltd.	Farmout Drillers, K. A. Cameron, Chairman, R. Hare and Associates, Managers, 20 Collins Street, Melbourne	102P	90	Barcaldine	Gravity	0·5	No Drilling Activity					

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
Gulf Interstate Overseas Ltd., W. J. Steeger, President, 1702 Esperson Building, Houston, Texas, U.S.A.; C. H. Wilson, Solicitor, Box 320E, G.P.O., Brisbane	Titleholder	88P Area A Area B	10,500 4,500	Torres Strait Cape Melville			No Drilling Activity					Area B is subject to an agreement with Corbett Reef Ltd., who are operators. Franklin C. Jones, Jnr., Vice President, Houston, Texas, C. H. Wilson, Box 320E, G.P.O., Brisbane
Longreach Oil Limited, M. Mackay, Chairman, Box 775, G.P.O.; Sydney, W. D. Mott, Consulting Geologist, Astor Court, Wharf and Leichhardt Streets, Brisbane	Titleholder (Richter–Bawden Drilling Pty. Ltd.)	87P	1,908	Ilfracombe			L.O.L. Hulton No. 1	10 miles N.N.W. of Brixton	2,169	2,169	Plugged as a dry hole	
							L.O.L. Marchmont No. 1	28 miles W.N.W. of Brixton	6,530	6,530	Plugged as a dry hole	
							L.O.L. Saltern Creek No. 1	12 miles N. of Brixton	4,966	4,966	Plugged as a dry hole	
Magellan Petroleum (Qld.) Pty. Ltd., T. S. M. Ranneft, Director, Box 455F, G.P.O., Brisbane	American Overseas Petroleum Ltd., R. L. Lay, Director, 485 Lexington Avenue, New York; E. R. Locke, Manager, Exploration Operations Australia, Box 1086N, G.P.O., Brisbane (Oil Drilling and Exploration Ltd.)	101P	18,683	Blackall–Mitchell			Amoseas Boree No. 1	24 miles S.S.E. of Blackall	8,781	8,781	Completed as a water well	Penetrated 1,548 feet of Devonian rock salt between 6,413 and 7,961 feet
							Amoseas Westbourne No. 1	22 miles S.S.W. of Tambo	4,867	4,867	Plugged as a dry hole	In respect of this title California Asiatic Oil Company and Texas Overseas Petroleum Company have an option over 50% and are directing exploration on this area. Operator is American Overseas Petroleum Limited (Amoseas)
Marathon Petroleum (Australia) Ltd., C. R. Loose, Western Hemisphere Exploration Manager, 539 South Main Street, Findlay, Ohio, U.S.A.; W. E. Swales, Exploration Manager, Box 687K, G.P.O., Brisbane	Titleholder	104P	11,100	Torres Strait	Seismic (Marine)	1	No Drilling Activity					
Mid-Wood Exploration Pty. Ltd., Rees B. Withers, Managing Director, 792 Elizabeth Street, Melbourne, C.1.; J. F. Fitzgerald, Secretary, Box 535H, G.P.O., Brisbane	Titleholder (Forasol, S.A.)	91P	25,000	Normanton			Mid-Eastern Woodside Burketown No. 1	22½ miles S. of Burketown	3,325	3,325	Completed as a water well	
Pacific American Oil Company, J. Abernathy, President, Box 8837, Oklahoma City, Oklahoma, U.S.A.; C. W. Siller, Vice President, 134 Adelaide Street, Brisbane, with whom is associated Shell Development (Australia) Proprietary Limited, Lewis Luxton, Chairman; J. Spinks, Exploration Manager, Shell Corner, 155 William Street, Melbourne, C.1, Victoria	Shell Development (Australia) Pty. Ltd.	70P	6,590	Maryborough–Bundaberg	Seismic (Marine)	0·13	No Drilling Activity					

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
The Papuan Apinaipi Petroleum Company Limited, G. H. R. Jones, Chairman, 53 Martin Place, Sydney; D. M. Traves, Exploration Director, Box 880L, G.P.O., Brisbane	Mines Administration Pty. Ltd. (Richter Bawden Drilling Pty. Ltd.)	54P	23,000	Boulia			P.A.P. Netting Fence No. 1	120 miles W. of Boulia	6,666	6,666	Plugged as a dry hole	
Phillips Petroleum Company (50%) and Sunray DX Oil Company (50%); Phillips: W. C. Hewitt, Vice President, International, Phillips Building, Bartlesville, Oklahoma, U.S.A.; J. J. Tanner, Manager, Australian Operations, Box 73A, G.P.O., Brisbane	Phillips Petroleum Company	71P	19,680	Gympie–Brisbane–Toowoomba	Seismic	2·6		No Drilling Activity				
	(Reading and Bates (Aust.) Pty. Ltd.)	72P	22,653	Charleville			Phillips–Sunray Quilberry No. 1	60 miles W. of Charleville	4,296		Drilling	
	(Delta Drilling Co.) ..	84P	13,500	Yaraka	Seismic	5·0	Phillips–Sunray Gilmore No. 1	120 miles N.W. of Charleville	14,260	14,260	Completed as a gas producer	
		105P	156	South-west of Aramac				No Drilling Activity				Title commenced 1–1–65
Planet Exploration Company Pty. Ltd., J. G. Fuller, Managing Director, 20 O'Connell Street, Sydney	Titleholder (Australian Drilling Company)	100P (Area A) (Area B)	200 400	South of Rolleston			Planet Warrinilla No. 2	59 miles N. of Injune	5,810	5,810	Plugged as a dry hole	
L. H. Smart Oil Exploration Co. Ltd., L. H. Smart, Chairman; R. F. Twist, Exploration Manager, Box 2670, G.P.O., Sydney	Alliance Oil Development Australia N.L., H. B. Borwick, Managing Director, 11th Floor, 100 Collins Street, Melbourne; L. W. Doggett, Agent, Box 218D, G.P.O., Brisbane	98P	3,000	North of Eromanga	Seismic	3		No Drilling Activity				Area is subject to an Agreement between L. H. Smart Exploration Co. and Alliance Oil Development Australia N.L. whereby the latter company may earn a 50% working interest in the title by conducting certain exploration work. Alliance Petroleum Australia N.L. has a 50% interest in Alliance Oil Development's interest
	Title holder	99P	8,900	Eromanga	Seismic	3·2		No Drilling Activity				
Union Oil Development Corporation and Kern County Land Company with reserved interest to Australian Oil and Gas Corporation	Union Oil: F. W. Hartley, President, Union Oil Centre, Los Angeles, California, U.S.A.; D. T. Graves, Resident Manager, Box 5048, G.P.O., Sydney; D. E. Pyle, Field Superintendent, P.O. Box 77, Toowoomba. (Oil Drilling and Exploration Ltd., Sante Fe Exploration Drilling Cov.)	57P	33,000	St. George–Miles	Geology Seismic	24 24·0	U.K.A. Alton No. 1	55 miles S.S.W. of Moonie, 49 miles E. of St. George	7,328	7,328	Completed as an oil well	
							U.K.A. Alton No. 2	55 miles S.S.W. of Moonie	6,139	6,139	Completed as an oil well	
							U.K.A. Alton No. 3	55 miles S.S.W. of Moonie	7,200	7,200	Completed as an oil well	
							U.K.A. Alton No. 4	55 miles S.S.W. of Moonie	7,292	7,292	Completed as an oil well	
							U.K.A. Alton No. 5	55 miles S.S.W. of Moonie	6,925	6,925	Completed as an oil well	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							U.K.A. Alton No. 6	55 miles S.S.W. of Moonie	6,805	6,805	Completed as an oil well	
							U.K.A. Boggo Creek No. 1	30 miles S. of Surat	6,257	6,257	Plugged as a dry hole	
							U.K.A. Booroondoo No. 1	42 miles S. of Tara	5,834	5,834	Plugged as a dry hole	
							U.K.A. Brigalow Creek No. 1	24 miles S.S.W. of Tara	730	5,777	Plugged as a dry hole	
							U.K.A. Cherwondah No. 1	32 miles N.W. of Miles	4,598		Drilling	
							U.K.A. Colgoon No. 1	10 miles W. of Surat	4,873	4,873	Plugged as a dry hole	
							U.K.A. Condamine No. 1	20 miles N.W. of Tara	5,015	5,015	Plugged as a dry hole	
							U.K.A. Conloi No. 1	21 miles N.W. of Miles	6,005	6,005	Completed as an oil well (Pumping)	
							U.K.A. Cooloomala No. 1	20 miles N.W. of Tara	4,992	4,992	Plugged as a dry hole	
							U.K.A. Crowder East No. 1	44 miles S.S.W. of Tara	5,544	5,544	Completed as a water well	
							U.K.A. Crowder North No. 1	43 miles S.S.W. of Tara	5,707	5,707	Plugged as a dry hole	
							U.K.A. Crowder South No. 1	45 miles S.S.W. of Tara	5,300	5,300	Plugged as a dry hole	
							U.K.A. Dockerill No. 1	40 miles S.S.W. of Tara	6,009	6,009	Completed as a water well	
							U.K.A. Dulacca No. 1	19 miles N.W. of Miles	6,469	6,469	Plugged as a dry hole	
							U.K.A. Giligulgul No. 1	24 miles N.W. of Miles	6,117	6,117	Completed as a water well	
							U.K.A. Goodar Road No. 1	46 miles S.S.W. of Tara	5,479	5,479	Plugged as a dry hole	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							U.K.A. Gurulmundi No. 1	17 miles N.N.W. of Miles	4,784	4,784	Plugged as a dry hole	
							U.K.A. Iminbah No. 1	43 miles S.S.W. of Tara	5,677	5,677	Plugged as a dry hole	
							U.K.A. Lawson No. 1	11 miles N.N.W. of Tara	5,413	5,413	Plugged as a dry hole	
							U.K.A. Marmadua No. 1	13 miles S.W. of Tara	4,931	4,931	Plugged as a dry hole	
							U.K.A. Miles Creek No. 1	20 miles N.W. of Tara	4,389	4,389	Plugged as a dry hole	
							U.K.A. Minnabilla No. 1	46 miles S.S.W. of Tara	5,526	5,526	Plugged as a dry hole	
							U.K.A. Moombah No. 1	54 miles S. of Surat	5,835	5,835	Plugged as a dry hole	
		P.L. No. 1					U.K.A. Moonie No. 18	Moonie Oilfield	5,827	5,827	Awaiting completion as an oil well	
		57P					U.K.A. Mundagai No. 1	29 miles S. of Tara	5,863	5,863	Plugged as a dry hole	
							U.K.A. Myall Creek No. 1	44 miles S.E. of Roma	7,159	7,159	Plugged as a dry hole	
							U.K.A. Picurda No. 1	12 miles E. of Condamine	3,995	3,995	Plugged as a dry hole	
							U.K.A. Piebald No. 1	17 miles S.E. of Tara	3,708	3,708	Plugged as a dry hole	
							U.K.A. Talwood No. 1	64 miles N.W. of Goondi-windi	6,109	6,109	Plugged as a dry hole	
							U.K.A. Tartha No. 1	30 miles S.W. of Tara	7,970	7,970	Plugged as a dry hole	
							U.K.A. Teelba No. 1	48 miles E. of St. George	7,372	7,372	Plugged as a dry hole	
							U.K.A. Tinhut No. 1	19 miles N. of Miles	3,467	3,467	Plugged as a dry hole	
							U.K.A. Warrigabie No. 1	48 miles S.S.W. of Tara	5,509	5,509	Plugged as a dry hole	

SUMMARY OF OIL SEARCH OPERATIONS IN QUEENSLAND, YEAR 1964—continued

Authorities to Prospect, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Authority to Prospect	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
							U.K.A. Weringa No. 1	40 miles N.N.W. of Miles	4,977	4,977	Completed as a water well	
							U.K.A. Wieambilla No. 1	15 miles N. of Tara	4,879	4,879	Plugged as a dry hole	
	Total Area ..	..	592,765 Sq. miles					Total Footage ..	742,181			

Prospecting Petroleum Permits, Titleholders and Names and Addresses of Principal Officers	Operating Company (Drilling Contractor)	Petroleum Prospecting Permit No.	Area in Square Miles	Locality	Field Surveys		Drilling Operations					General Remarks
					Type	Party Months	Well Name	Location	Footage Drilled	Total Depth	Status at Year's End	
Condamine Oil Ltd., H. V. Mead, Secretary, Box 1717V, G.P.O., Brisbane	Titleholder (Sedco Exploration (Australia) Pty. Ltd.)	708	100	North of Chinchilla	Gravity	1	Condamine Canaan No. 1	25 miles N. of Chinchilla	1,635	1,635	Plugged as a dry hole	
Standard Gas Pty. Ltd., L. G. Neill, Managing Director, 307 Queen Street, Brisbane	Titleholder	715	200	Brisbane	None			No Drilling Activity				
	Total Area ..	..	300 Sq. miles					Total Footage ..	1,635			

Total Exploration/Appraisal/Development footage drilled on Authorities to Prospect 742,181

Total Exploration/Appraisal/Development footage drilled on Prospecting Petroleum Permits .. 1,635

Grand Total 743,816

TABLE 1–3

EXPLORATION DRILLING

This section presents in summary form the main information about each of of the wells drilled in Queensland for petroleum or for stratigraphic information in 1964. The details of each well were taken from well completion reports and progress reports submitted to the Department of Mines by the companies concerned. The stratigraphic names are those used by the companies, and not necessarily in accordance with the Australian Code of Stratigraphic Nomenclature.

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Dates Spud Rig Release	T.D. or P.D. at 31–12–64	Intention	Formation Tops	Shows, Tests	Status 31–12–64; Remarks
Amalgamated, Back Creek No. 1	55/56	26° 46′ 00″ 149° 06′ 42″	Ft. 982 RT 969 GL	9–3–64 24–3–64	Ft. 5,295	To investigate the lithology and fluid content of the lower Mesozoic section	Ft. Surf. Roma .. .. 848 Blythesdale 1,995 Injune Creek 3,430 Hutton 4,103 Evergreen 4,270 Hystrichosphaerid 4,435 Precipice 4,522 Clematis 4,745 Showground 4,800 Rewan 5,014 Bandanna 5,137 Mantuan 5,200 Volcanics 5,208 Timbury Hills	DST No. 1 4,478–4,498′, 1,190′ gassy sl. mdy. water DST No. 2 4,750–4,793′, No rec., GTS 3 mins at 1·7 Mmcf/d. DST No. 3 4,793–4,816′, rec. 30′ GCM	Cased as a potential gas producer
Amalgamated, Cometside No. 1	55/56	24° 39′ 30″ 148° 48′ 06″	836 RT 824 GL	5–3–64 9–4–64	5,562	To examine the Permian section over the Purbrook anticline	Surf. Rewan .. .. 630 Bandanna 1,740 Dry Creek 2,080 Early Storms 2,422 Ingelara 3,238 Aldebaran 4,225 Cattle Creek 5,115 Unit 8 5,528 Timbury Hills	None	Plugged and abandoned
Amalgamated, Duncan Creek No. 1 ..	55/56	26° 50′ 45″ 148° 43′ 50″	1,000 RT 988 GL	22–12–64	2,247	To examine the lower Mesozoic on the Duncan Creek structure	..	..	Drilling
Amalgamated, Motley No. 1	55/56	24° 38′ 52″ 148° 46′ 23″	782 RT 769 GL	13–4–64 11–5–64	4,187	To test the western flank of the central part of the Purbrook structure	Surf. Rewan .. .. 645 Bandanna 1,730 Dry Creek 2,070 Early Storms 2,440 Ingelara 3,220 Aldebaran 4,178 Cattle Creek	None	Plugged and abandoned
Amalgamated, Purbrook South No. 1 ..	55/56	24° 49′ 30″ 148° 46′ 40″	830 RT 817 GL	16–5–64 19–6–64	5,582	To test the Permian section on the southern end of the Purbrook anticline	Surf. Rewan .. .. 1,907 Bandanna 3,020 Dry Creek 3,310 Early Storms 3,642 Ingelara 4,430 Aldebaran 5,418 Cattle Creek	DST No. 1 4,445–4,567′, no blow, rec. 20′ mud	Plugged and abandoned
Amalgamated, Snake Creek No. 1 ..	55/56	26° 50′ 35″ 149° 07′ 18″	957 RT 944 GL	6–6–64 23–6–64	5,270	To test the lower Mesozoic section on the Snake Creek high	Surf. Roma .. .. 1,000 Blythesdale 1,000 Transition 1,169 Mooga 1,463 Fossilwood 1,904 Gubberamunda 2,249 Injune Creek 3,687 Hutton 4,315 Evergreen 4,491 Hystrichosphaerid 4,650 Precipice 4,740 Clematis 5,034 Showground 5,050 Rewan 5,246 Bandanna	DST No. 1 4,969–5,079′, 6¼ Mmcf/d., rec. 30′ condensate and gas cut mud DST No. 2 5,082–5,190′, GTS 12 mins. at 50 Mcf/d., 850′ mud Precipice showed gas at 4,720′, Rewan showed gas in SWC	Completed as a potential gas producer
Amalgamated, Wallabella No. 1	55/56	26° 46′ 50″ 149° 09′ 55″	963 KB 950 GL	6–2–64 4–3–64	6,350	To test for petroleum in the eastern part of Combarngo farm-in area	Surf. Roma .. .. 893 Blythesdale 2,147 Injune Creek 3,629 Hutton 4,332 Evergreen 4,702 Precipice	DST No. 1 4,753–4,118′, 90′ WM, 110′ VSGCMW DST No. 2 5,135–5,156′, NGTS, rec. 40′, WM, 210′ GCMW	Converted to a water well

								4,737 Moolayember 4,822 Clematis 5,136 Showground 5,160 Rewan 5,576 Bandanna 5,890 Mantuan 5,986 Dry Creek 6,210 Early Storms 6,305 Combarngo(Volcanics)	DST No. 3 5,486–5,494′, GIP, GAB, GTS 32 mins. at RTSTM, rec. 30′ GCM DST No. 4 5,491–5,514′, WIP, WAB, NGTS, rec. 40′, GCM w/trace of oil DST No. 5 6,225–6,210′, FIP, FAB, NGTS, rec. 120′ mud	
Amalgamated, Yalebone No. 1	55/56	26° 55′ 37″ 148° 51′ 38″	935 KB 922 GL	9–12–64 19–12–64	4,909	To test the Precipice on the Yalebone structure	Surf. Roma .. .. 853 Transition 1,260 Mooga 2,558 Injune Creek 3,733 Hutton 4,298 Evergreen 4,470 Boxvale 4,646 Precipice 4,663 Moolayember 4,894 Granite	None	Converted to a water well
Amoseas, Boree No. 1	101	24° 45′ 32″ 145° 34′ 36″	1,110 KB 1,094 GL	3–5–64 25–6–64	8,781	To test the Mesozoic and Palaeozoic on a seismic high	Surf. Tambo .. .. 640 Roma 1,448 Blythesdale 2,149 Walloon 2,454 Hutton-Precipice equiv 3,356 Clematis equiv. 3,786 Upper Permian 4,009 Lower Permian 4,457 Middle Devonian 6,298 Lower Devonian 6,413 Boree Salt 7,961 Carbonate 8,545? Silurian 8,779 Silicified Arkose	None	Converted to a water well Penetrated 1,548′ of Devonian rock salt. (Boree Formation)
Amoseas, Westbourne No. 1	101	25° 11′ 27″ 146° 08′ 02″	1,247 KB 1,231 GL	8–4–64 23–4–64	4,867	To test the Mesozoic and Palaeozoic on main culmination of Ward River anticline	Surf. Roma–Tambo 902 Blythesdale 1,880 Walloon 2,244 Hutton 3,302 Moolayember 3,884 Clematis 4,484 Permian 4,602 Pre-Permian metamorphics	None	Plugged and abandoned
A.A.O., Beaufort No. 1	55/56	26° 34′ 30″ 148° 54′ 35″	1,018 KB 1,007 GL	23–6–64 6–7–64	3,836	Test Precipice Sandstone on Block 16—Warooby Axis	Surf. Blythesdale .. .. Transition ? Mooga 552 Fossilwood 1,072 Gubberamunda 1,288 Injune Creek 2,655 Hutton 3,209 Evergreen 3,645 Precipice 3,670 Moolayember 3,777 Granite wash 3,808 Granite	Precipice–Moolayember tested 3,655–3,836′, GTS 5 mins. inc. to 914 Mcf/d., rec. 195′ GCM, 3,605–3,660′, GIP, GTS 10 mins at 100 Mcf/d.	Completed as a potential gas well
A.A.O., Belbri No. 1	55/56	26° 25′ 03″ 148° 55′ 35″	1,461 KB 1,450 GL	11–11–64 19–11–64	3,500	Test Precipice on axes of a major nosing trend	Surf. Alluvium and basalt boulders 120 Blythesdale 120 Transition 120 Mooga 250? Fossilwood 797 Gubberamunda 935 Injune Creek 2,220 Hutton 3,027 Evergreen 3,423 Precipice 3,466 Moolayember 3,496 Granite	Tested Precipice 3,415–3,500′, GTS 46 mins. at 17·5 Mcf/d., rec. 120′ mud	Converted to a water well
A.A.O., Bella Farm No. 1	55/56P	26° 35′ 51″ 148° 53′ 53″	990 KB 979 GL	11–6–64 21–6–64	3,911	To test lower Mesozoic on west flank of Block 16—Warooby Axis	Surf. Blythesdale .. .. Surf. Transition ? Mooga 645 Fossilwood 1,165 Gubberamunda 1,350 Injune Creek 2,732 Hutton 3,288 Evergreen 3,704 Precipice 3,723 Moolayember 3,857 Showground 3,863 Timbury Hills	Precipice tested 3,701–3,911′, rec. 66′, mud and 1,270′ gas cut water.	Plugged and abandoned

TABLE 1–3—continued

EXPLORATION DRILLING—continued

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Dates Spud Rig Release	T.D. or P.D. at 31–12–64	Intention	Formation Tops	Shows, Tests	Status 31–12–64; Remarks
A.A.O., Beryl No. 1	86	22° 22′ 08″ 143° 58′ 26″	Ft. 882 KB 871 GL	10–7–64 19–7–64	Ft. 4,154	To test the crestal area of the Beryl structure (seismic high)	Ft. Surf. Winton .. .. 662 Tambo 1,620 Toolebuc 1,660 Roma 2,230 Blythesdale 2,738 Walloon 2,930 Bundamba 3,280 Bandanna 3,640 Unnamed 4,060 Basement	DST No. 1 3,976–4,150′, WIP, WAB, died in 20 mins., WIP, WAB, died in 4 mins., rec. 30′ watery mud, 170′ muddy water	Plugged and abandoned
A.A.O., Bindaroo No. 1	55/56	26° 37′ 20″ 149° 01′ 10″	1,148 KB 1,137 GL	14–12–64 23–12–64	4,460	Test Precipice and Showground on southern end of Block 16–Warooby axis	Surf. Roma .. .. 668 Transition 892 Fossilwood 1,411 Gubberamunda 1,620 Injune Creek 2,950 Hutton 3,807 Evergreen 4,097 Precipice 4,118 Moolayember 4,290 Showground 4,297 Bandanna 4,440 Granite	Precipice tested 4,100–4,125′, NGTS, rec. 3,950′ water	Plugged and abandoned
A.A.O., Binya No. 1	55/56	26° 41′ 57″ 148° 31′ 20″	1,290 KB 1,279 GL	7–7–64 17–7–64	4,318	To test Precipice and Boxvale Sandstones on Binya structure and investigate pinchout on E. edge of Arbroath trough	Surf. Roma .. .. 912 Blythesdale 912 Transition 1,290 Mooga 1,648 Fossilwood 2,109 Gubberamunda 2,260 Injune Creek 3,218 Hutton 3,905 Evergreen 4,208 Precipice 4,260 Timbury Hills	Boxvale tested 4,020–4,064′, rec. 1,085′ water Precipice tested 4,214–4,318′, rec. 30′ mud	Plugged and abandoned
A.A.O., Blyth Creek No. 1	55/56	26° 37′ 22″ 148° 57′ 05″	1,010 KB 999 GL	1–3–64 16–3–64	3,998	Test Precipice and Showground Sandstones on southern end of Block 16—Warooby axis	Surf. Blythesdale .. .. Surf. Transition 484 Mooga 714 Fossilwood 1,187 Gubberamunda 1,387 Injune Creek 2,786 Hutton 3,437 Evergreen 3,775 Precipice 3,832 Moolayember 3,906 Timbury Hills	Precipice tested 3,786–3,820′, GTS 1 min. at 8·4 Mmcf/d., rec. 2′ condensate contaminated water Moolayember tested 3,822–3,835′, GTS 2 mins., WTS 13 mins., gas at 400 Mcf/d., water at estimated 900 BPD, rec. 850′, water 3,823–3,998′, GTS 5 mins., GCM in 30 mins. and 800 BPD water, rec. 1,150′ water	Cased as a potential gas well
A.A.O., Blythewood No. 1	55/56	26° 43′ 29″ 148° 53′ 37″	957 KB 946 GL	2–2–64 14–2–64	4,320	To test Precipice on Ingle – Applegrove axis	Surf. Roma .. .. 480 Blythesdale 480 Transition 830 Mooga 1,200 Fossilwood 1,595 Gubberamunda 1,820 Injune Creek 3,190 Hutton 3,742 Evergreen 3,900 Hystrichosphaerid 4,096 Precipice 4,137 Moolayember 4,286 Timbury Hills	Precipice tested 4,103–4,337′, NGTS, rec. 110′ of mud	Plugged and abandoned
A.A.O., Boondara No. 1	55/56	26° 54′ 21″ 149° 06′ 32″	959 KB 944 GL	23–7–64 7–8–64	5,859	To test the Precipice, Showground and Rewan on a seismic structure	Surf. Glenmorgan 210 Roma 1,055 Blythesdale 1,055 Transition 1,370 Mooga 1,610 Fossilwood 2,085 Gubberamunda 2,420 Injune Creek 3,900 Hutton	Moolayember tested 5,044–5,119′, rec. 150′ muddy water Precipice showed slight gas bleeding in most porous parts Granite showed yellow fluorescence	Converted to a water well

								4,541 Evergreen 4,850 Precipice 4,892 Moolayember 5,270 Showground 5,286 Rewan 5,475 Bandanna 5,666 Mantuan 5,714 Combarngo 5,830 Granite		
A.A.O., Bore View No. 1	55/56	26° 33′ 52″ 149° 05′ 35″	1,084 KB 1,073 GL	2–5–64 25–5–64	4,960	To test Precipice and Showground Sandstones on nosing trend	Surf. Roma .. .. 200 Blythesdale 200 Transition 492 Mooga 696 Fossilwood 1,182 Gubberamunda 1,413 Injune Creek 2,833 Hutton 3,438 Evergreen 3,971 Precipice 4,007 Moolayember 4,208 Showground (?) 4,224 Rewan 4,500 Bandanna 4,820 Timbury Hills	Rewan oil show Precipice–Moolayember tested 3,986–4,071′, gas at RTSTM, rec. 50′ gas cut mud	Converted to a water well
A.A.O., Buckenan Downs No. 1	55/56	26° 36′ 48″ 148° 48′ 16″	1,018 GL 1,029 KB	24–12–64	2,960	To test the Precipice Sandstone on Ingle–Applegrove axis	..	..	Drilling
A.A.O., Bungil No. 1	55/56	26° 39′ 52″ 148° 49′ 50″	963 KB 952 GL	24–4–64 2–5–64	4,103	To test Precipice Sandstone on Ingle – Applegrove axis	Surf. Roma .. .. 430 Blythesdale 430 Transition 713 Mooga 918 Fossilwood 1,428 Gubberamunda 1,651 Injune Creek 2,912 Hutton 3,547 Evergreen 3,921 Precipice 3,942 Moolayember 4,060 Timbury Hills	Precipice tested 3,885–4,103′, GTS 20 mins., initially at 98 Mcf/d. decreasing to TSTM, rec. 85′ mud	Converted to a water well
A.A.O., Coolibah No. 1	55/56	26° 38′ 43″ 148° 47′ 36″	1,067 KB 1,056 GL	29–7–64 9–8–64	4,313	To test Precipice on nosing trend	Surf. Roma .. .. 470? Blythesdale 470? Transition 870 Mooga 1,051 Fossilwood 1,616 Gubberamunda 1,784 Injune Creek 3,030 Hutton 3,713 Evergreen 4,057 Precipice 4,108 Moolayember 4,290 Timbury Hills	Precipice tested 4,066–4,118′, GTS 15 mins. at 165 Mcf/d., rec. 80′ mud Interval 4,181–4,313′, rec. 80′ mud, 20′ muddy water Shows: 4,068–4,118′, very sl. bleeding, sl. odour, sl. fluorescence and cut	Plugged and abandoned
A.A.O., Coolibah East No. 1	55/56	26° 39′ 30″ 148° 48′ 44″	1,111 KB 1,100 GL	25–10–64 1–11–64	4,300	To test the lower Mesozoic on minor axis on flank of the Bungeworgorai axis	Surf. Roma .. .. 494 Blythesdale 494 Transition 870 Mooga 1,055 Fossilwood 1,595 Gubberamunda 1,789 Injune Creek 3,071 Hutton 3,713 Evergreen 4,044 Precipice 4,091 Moolayember 4,262 Timbury Hills	No shows No tests	Plugged and abandoned
A.A.O., Dalmuir No. 1	55/56	26° 25′ 00″ 149° 04′ 20″	1,191 KB 1,180 GL	1–9–64 16–9–64	4,367	Stratigraphic traps on down-thrown side of Hutton–Wallumbilla fault	Surf. Blythesdale .. .. Surf. Mooga 100 Fossilwood 622 Gubberamunda 746 Injune Creek 2,158 Hutton 2,963 Evergreen 3,406 Precipice 3,447 Moolayember 3,656 Showground 3,661 Rewan 4,030 Bandanna 4,351 Granite	Showground tested 3,617–3,673′, rec. 1,950′ water	Plugged and abandoned

TABLE 1–3—continued

EXPLORATION DRILLING—continued

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Dates Spud Rig Release	T.D. or P.D. at 31–12–64	Intention	Formation Tops	Shows, Tests	Status 31–12–64; Remarks
A.A.O., Dirinda No. 1	55/56	26° 40′ 47″ 148° 40′ 32″	Ft. 1,038 KB 1,027 GL	16–11–64 29–11–64	Ft. 4,296	To test Precipice and Boxvale on west flank of Roma Shelf	Ft. Surf. Roma .. .. 930 Mooga 1,112 Fossilwood 1,646 Gubberamunda 1,833 U. Injune Creek 2,937 Hutton 3,628 Evergreen 3,798 Boxvale 3,965 Timbury Hills	Boxvale tested 3,801–3,853′—tight Timbury Hills tested 3,965–4,000′, GTS 10 mins. at 86·5 Mcf/d., rec. 590′ 52° API oil and 280′ oil and gas cut mud Timbury Hills tested 4,000–4,037′, GTS 45 mins. at 7 Mcf/d., rec. 120′ oil 300′ oil and gas cut mud Timbury Hills tested 4,037–4,085—tight	Plugged and abandoned
A.A.O., Duarran No. 1	55/56	26° 41′ 55″ 148° 48′ 33″	945 KB 934 GL	25–6–64 4–7–64	4,315	To test Precipice Sandstone on axis of nosing trend	Surf. Roma .. .. 449 Blythesdale 449 Transition 835 Mooga 1,202 Fossilwood 1,600 Gubberamunda 1,795 Injune Creek 2,957 Hutton 3,703 Evergreen 3,805 Hystrichosphaerid 4,025 Precipice 4,068 Moolayember 4,288 Timbury Hills	Precipice tested 4,042–4,072′, GTS in 6 mins. at 472 Mcf/d., rec. 210′ of 37° API oil and 860′ of brackish water	Plugged and abandoned
A.A.O., Kalima No. 1	55/56	26° 06′ 04″ 148° 45′ 11″	1,346 KB 1,335 GL	2–11–64 8–11–64	2,173	To test possible hydrodynamic accumulation on Rosewood structure	Surf. Injune Creek .. 585 Hutton 1,470 Evergreen 1,840 Precipice 1,990 Moolayember 2,120 Granite wash 2,150 Granite	Precipice tested 1,899–1,952′, rec. 1,600′ water	Converted to a water well
A.A.O., Lamen No. 1	55/56	26° 37′ 50″ 148° 59′ 25″	1,070 KB 1,059 GL	21–11–64 30–11–64	4,074	To test Precipice and Showground on southern end of Block 16–Warooby axis	Surf. Blythesdale .. .. 562 Mooga 773 Fossilwood 1,328 Gubberamunda 1,572 Injune Creek 2,752 Hutton 3,520 Evergreen 3,920 Marker 3,964 Moolayember	Precipice tested 3,925–3,947′, GTS 1½ mins. at 7·34 Mmcf/d., rec. 15′ condensate	Cased as a potential gas well
A.A.O., Latemore E. No. 2	55/56	26° 36′ 57″ 149° 05′ 22″	1,074 KB 1,063 GL	1–12–64 13–12–64	4,751	To test lower Mesozoic on flank of Latemore seismic structure	Surf. Blythesdale .. .. 598 Mooga 797 Fossilwood 1,344 Gubberamunda 1,572 Injune Creek 2,983 Hutton 3,791 Evergreen 3,980 Oolite 4,178 Precipice 4,203 Moolayember — Showground 4,387 Rewan 4,658 Bandanna	DST No. 1 4,188–4,215′, WIP, NGTS, rec. 60′ mud, 110′ muddy water	Plugged and abandoned
A.A.O., Mount Hope No. 1	55/56	26° 24′ 06″ 149° 05′ 24″	1,122 KB 1,113 GL	3–4–64 12–4–64	2,562	To test Precipice Sandstone on seismic high	Surf. Blythesdale .. .. 305 Injune Creek 1,716 Hutton 2,213 Evergreen 2,524 Granite	No shows No tests	Plugged and abandoned
A.A.O., Quibet No. 1	55/56	26° 27′ 06″ 148° 50′ 25″	1,197 KB 1,186 GL	24–7–64 5–8–64	3,555	To test Precipice on Block 16–Warooby axis	Surf. Blythesdale .. .. Surf. Fossilwood 823 Gubberamunda 1,016 Injune Creek 2,198 Hutton 2,957 Evergreen 3,414 Precipice	Tested Precipice, Moolayember, 3,325–3,474′, GTS ½ min. at RTSTM, rec. 2,469′ water Tested Precipice 3,428–3,446′, GTS 28 mins. at RTSTM, rec. 2,840′ water Tested Moolayember 3,457–3,471′, GTS 33 mins. at RTSTM, rec. 765′ water	Converted to a water well

								3,453 Moolayember 3,484 Granite wash 3,530 Roma Granite	Tested Moolayember–Granite wash 3,473–3,545′, tight, rec. 5′ mud	
A.A.O., Raslie No. 1	55/56	26° 29′ 40″ 149° 04′ 48″	1,228 KB 1,217 GL	16–9–64 2–10–64	4,387	To test Precipice and Showground Sandstones over Raslie seismic structure	Surf. Blythesdale .. .. Surf. Transition 180 Mooga 440 Fossilwood 960 Gubberamunda 1,153 Injune Creek 2,543 Hutton 3,408 Evergreen 3,710 Precipice 3,790 Moolayember 3,948 Showground 3,980 Rewan 4,157 Bandanna 4,360 Granite	Precipice tested 3,700–3,773′, GTS 4 mins. at 4·1 Mmcf/d. no recovery Showground tested 3,940–3,967′, GTS 8 mins. at RTSTM, rec. 120′ oil cut mud 3,590′ oil cut water Shows: 3,723–3,743′, v. sl. gas blow and odour 3,952–3,955 gas and oil bleeding	Completed as a gas well
A.A.O., Sawpit Creek No. 1	55/56	26° 29′ 55″ 149° 09′ 25″	1,283 KB 1,272 GL	15–4–64 29–4–64	3,753	To test Precipice Sandstone pinch-out on S.E. plunging ridge E. of Hutton–Wallumbilla fault	Surf. Blythesdale .. .. Surf. Mooga 304 Fossilwood 870 Gubberamunda 964 Injune Creek 2,418 Hutton 3,040 Evergreen 3,547 Precipice 3,575 Bandanna 3,638 Mantuan–Dry Creek 3,668 Granite	Tested 3,558–3,595′, rec. 410′ water Tested Mantuan–Basement 3,610–3,752′, rec. 10′ mud Bandanna showed oil bleeding in core (3,572–3,597′) Granite showed odour fluorescence and cut core (3,740–3,753′)	Plugged and abandoned
A.A.O., Sleepy Creek No. 1	55/56	26° 26′ 50″ 148° 55′ 45″	1,284 KB 1,273 GL	7–8–64 17–8–64	3,392	To test lower Mesozoic on closure on Solitary Creek axis	Surf. Blythesdale .. .. Surf. Fossilwood 620 Gubberamunda 870 Injune Creek 2,115 Hutton 2,883 Evergreen 3,288 Precipice 3,303 Moolayember 3,352 Roma Granite	Precipice tested 3,280–3,306′, GTS 11 mins. at 192 Mcf/d., no recovery	Converted to a water well
A.A.O., Tineen No. 1	55/56	26° 31′ 45″ 148° 45′ 00″	1,093 KB 1,082 GL	18–7–64 27–7–64	3,680	To test Precipice and Showground Sandstones on the northern end of the Ingle – Applegrove axis	Surf. Blythesdale .. .. 520 Fossilwood 1,021 Gubberamunda 1,247 Injune Creek 2,495 Hutton 3,143 Evergreen 3,494 Precipice 3,515 Moolayember 3,638 Timbury Hills	DST No. 1 3,493–3,552′, WIP, WAB, NGTS, rec. 8′ mud DST No. 2 3,411–3,680′, WIP, WAB, NGTS, rec. 70′ mud	Plugged and abandoned
A.A.O., Warooby South No. 1	55/56	26° 35′ 46″ 148° 55′ 46″	996 KB 985 GL	17–2–64 28–2–64	3,890	To test the Precipice and Showground Sandstones on the axis of the Block 16 —Warooby nose	Surf. Tertiary .. .. 45 Blythesdale 45 Transition 265 Mooga 577 Fossilwood 1,087 Gubberamunda 1,303 Injune Creek 2,614 Hutton 3,278 Evergreen 3,678 Precipice 3,707 Moolayember 3,760 Timbury Hills	DST No. 1 3,663–3,717′, FIP, GTS after 25 mins. at 80 Mcf/d., rec. 75′ mud DST No. 2 3,673–3,890′, small IP, GTS after 10 mins. at 27 Mcf/d., rec. 178′ gas-cut mud, 400′ water	Plugged and abandoned
A.A.O., Wattanooka No. 1	55/56	26° 33′ 45″ 149° 02′ 23″	1,092 KB 1,081 GL	26–5–64 9–6–64	4,505	To test the Precipice and Showground Sandstones on a nosing trend	Surf. Roma .. .. ? Blythesdale ? Transition ? Mooga 597 Fossilwood 1,152 Gubberamunda 1,320 Injune Creek 2,810 Hutton 3,496 Evergreen 3,890 Precipice 3,904 Moolayember 4,129 Showground 4,150 Rewan 4,210 Bandanna 4,455 Timbury Hills	Showground–Rewan tested 4,132–4,218′, GTS, 21 mins. at RTSTM, rec. 4,100 ft. water Precipice tested 3,853–3,919′, rec. 340′ muddy water	Plugged and abandoned

TABLE 1–3—continued

EXPLORATION DRILLING—continued

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Dates Spud Rig Release	T.D. or P.D. at 31–12–64	Intention	Formation Tops	Shows, Tests	Status 31–12–64; Remarks
A.A.O., Wyena No. 1	55/56	26° 28′ 10″ 149° 08′ 40″	Ft. 1,325 KB 1,314 GL	3–9–64 13–9–64	Ft. 3,713	Precipice pinchout test	Ft. Surf. Blythesdale .. .. Surf. Fossilwood 600 Gubberamunda 800 Injune Creek 2,164 Hutton 3,082 Evergreen 3,436 Precipice 3,490 Bandanna 3,613 Granite wash 3,698 Granite	Precipice tested 3,425–3,480′, NGTS, rec. 1,000′ water Moolayember–Bandanna–Granite Wash tested 3,525–3,708′, GTS 40 mins. at RTSTM	Plugged and abandoned
A.A.O., Yanalah No. 1	55/56	26° 31′ 42″ 148° 51′ 17″	1,183 KB 1,172 GL	8–7–64 22–7–64	4,136	To test the Precipice and Showground Sandstones over a minor closure on the Block 16—Warooby axis	Surf. Blythesdale .. .. Surf. Transition 432 Mooga 587 Fossilwood 1,137 Gubberamunda 1,342 Injune Creek 2,663 Hutton 3,367 Evergreen 3,733 Precipice 3,807 Moolayember 3,875 Showground 3,903 Bandanna 3,939 Basal Conglomerate 4,039 Timbury Hills	DST No. 1 3,731–3,983′, VSIP, GTS, 2 mins. at 3·2 Mmcf/d.	Completed as a gas well
A.F.O., Arcturus No. 1	55/56	24° 03′ 40″ 148° 30′ 00″	605 KB 590 GL	13–9–64 21–11–64	6,195	To test seismic structure	Surf. Basalt .. .. 580 Bandanna 2,340 Mantuan 2,385 Dry Creek 3,122 Early Storms 3,290 Ingelara 3,413 Aldebaran 5,050 Cattle Creek	Bandanna tested 1,690–1,758′, GTS, 1 min. at 3·5 Mmcf/d., no recovery Bandanna tested 1,550–1,690′, NGTS, rec. 10′ mud Bandanna tested 1,860–1920′, GTS, 1 min. at 1·6 Mmcf/d., rec. 100′ mud Bandanna tested 1,920–2,120′, GTS, 2 mins. at 1·25 Mmcf/d. Dry Creek tested 2,510–2,580′, GTS, 1 min. at 990 Mcf/d., rec. 100′ mud Early Storms tested 3,130–3,240′, NGTS, rec. 100′ mud Aldebaran tested 3,400–3,661′, NGTS, rec. 600′ mud Aldebaran tested 4,200–4,270′, NGTS, rec. 40′ mud	Completed as a gas well
A.F.O., Rolleston No. 1	55/56	24° 33′ 47″ 148° 37′ 52″	694 KB 683 GL	20–10–63 14–2–64	9,508	To test Permian section over Rolleston structure	Surf. Alluvium .. .. 79 Bandanna U. 1,389 Bandanna L. 1,850 Mantuan 1,920 Dry Creek U. 2,400 Dry Creek L. 2,943 Early Storms 3,013 Ingelara 3,123 Aldebaran 4,597 Cattle Creek 7,114 Stanleigh 8,730 Rolleston	Perforated 2,945–2,980′, Open Flow Potential 43·070 Mmcf/d., plus 50° API condensate at about 1,661 per Mmcf.	Completed as a gas well
Australian Aquitaine, Fermoy No. 1 ..	86	23° 08′ 32″ 143° 03′ 26″	808 KB 791 GL	11–8–64 25–9–64	5,262	To test the Fermoy structure	12 Winton .. .. 1,100 Mackunda 1,608 Tambo 2,595 Toolebuc 2,708 Roma 3,375 Transition 3,576 " U. Sst." 3,829 " Sh. sst. sequ." 4,620 " L. Sst." 4,978 " Basal S. Sh." 5,040 " Metamorphic Sh."	DST No. 1 3,537–3,604′, GIP, GAB, NGTS, rec. 700′ water DST No. 2 3,946–3,980′, WIP, WAB, NGTS, rec. 1,629′ W.C. DST No. 3 4,432–4,456′, WIP, WAB, NGTS, rec. 1,626′ W.C. DST No. 4 4,622–4,687′, GIP, GAB, NGTS, rec. 1,626′ W.C. and 1,513′ water DST No. 5 4,883–4,994′, GIP, GAB, NGTS	Plugged and abandoned

Australian Aquitaine, Mayneside No. 1 ..	86	23° 35′ 23″ 142° 31′ 11″	674 KB 661 GL	29–10–64 27–11–64	5,382	To test the Mayneside structure	Surf. Winton .. .. 450 Tambo 2,950 Toolebuc 3,020 Tambo 3,705 Blythesdale 3,705 Transition 3,908 Mooga 4,170 Fossilwood 4,320 Gubberamunda 4,565 Walloon 5,000 Bandanna 5,102 Drummond	DST No. 1 3,939–4,005′, No blow DST No. 2 4,993–5,050′, Tool opened with good blow DST No. 3 5,102–5,189′, Tool opened with small blow, NGTS, rec. 1,643′ W.C.	Plugged and abandoned
Condamine Oil Ltd., Canaan No. 1 ..	PPP708	26° 27′ 38″ 150° 42′ 47″	1,074 KB 1,067 GL	4–7–64 26–7–64	1,635	To test Canaan seismic structure	Surf. Hutton .. .. 830 Evergreen 1,526 Precipice 1,571 Camboon	DST 1,520–1,635′, rec. 800′ mud, 380′ water	Plugged and abandoned
Exoil–Transoil, Lake Galilee No. 1 ..	76	22° 11′ 33″ 145° 58′ 32″	961 KB 947 GL	10–7–64 27–11–64	11,175	Stratigraphic test of Palaeozoic section on seismic high	Surf. Cainozoic .. .. 175 Moolayember equiv. 1,100 Clematis equiv. 1,770 Rewan equiv. 2,828 U. Permian 3,476 L. Perm. Carb.? 9,320 Devonian	Shows: Permian showed gas in various intervals from 2,846–9,038′, 80% higher hydrocarbons at 8,987–8,993′, Devonian showed faint blue fluorescence and cut 10,340–10,369′ Tests: 3,448–3,491′, rec. 20′ mud, 3,314–3,488′, rec. 870′ mud, 8,150–8,183′, rec. 60′ mud, 8,679–8,752′, rec. 10′ oil, 43·1° API 380′, GCM, GTS,TSTM, 8,985–9,080′, rec. 1,444′, brackish water 810′, mud (both slightly gas cut), 10,332–10,395′, rec. 3,500′, water cushion	Plugged and abandoned Plugged and abandoned
French Petroleum, Marduroo No. 1 ..	66/67	24° 02′ 20″ 139° 54′ 15″	321 KB 308 GL	18–10–64 28–11–64	3,861	Stratigraphic	Surf. Quaternary 50 Tambo 540 Roma 920 Blythesdale 1,242 Disconformity on Proterozoic Formations	No show or test	Plugged and abandoned
French Petroleum, The Brothers No. 1 ..	66/67	24° 15′ 40″ 139° 20′ 30″	308 KB 295 GL	5–12–64 31–12–64	4,173	Stratigraphic	Surf. Quaternary .. 50 Tambo 392 Roma 875 Blythesdale 1,153 Disconformity on Cambrian Formation	No show or test	Plugged and abandoned
Longreach Oil, Hulton No. 1	87	23° 23′ 25″ 144° 55′ 20″	772 KB 759 GL	24–5–64 30–5–64	2,169	Test petroleum potential of Mesozoic and Permian on seismic culmination	Surf. Tambo .. .. 400 Roma 930 Blythesdale 1,283 Walloon 1,500 Hutton 1,830 Mantuan and U. Colinlea equiv. 2,058 Drummond Group	No show or test	Plugged and abandoned
Longreach Oil, Marchmont, No. 1 ..	87	23° 10′ 15″ 144° 44′ 21″	755 KB 740 GL	8–6–64 3–7–64	6,530	Stratigraphic test on down-thrown side of monoclinal seismic feature	Surf. Tambo .. .. 1,555 Roma 2,097 Blythesdale 2,607 Walloon 2,845 Hutton 3,305 Bandanna 4,170 Mantuan equiv. 4,307 Colinlea 6,510 Joe Joe	Shows: Coal gas 3,200–4,200′, 4,300–4,600′, 6,050–T.D.? Fluor., cuts 4,120–4,250′ Tests: 4,222–4,340′, rec. 15′ mud 4,416–4,476′, rec. 10′ mud	Plugged and abandoned
Longreach Oil, Saltern Creek No. 1 ..	87	23° 20′ 54″ 144° 56′ 24″	768 KB 753 GL	29–4–64 19–5–64	4,966	Stratigraphic off-structure test in pinchout area	Surf. Tambo .. .. 887 Roma 1,405 Blythesdale 1,840 Walloon 2,083 Hutton 2,500 Bandanna 3,400 Mantuan 3,525 Colinlea 4,770 Drummond	No show or test	Plugged and abandoned

TABLE 1–3—continued

EXPLORATION DRILLING—continued

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Dates Spud Rig Release	T.D. or P.D. at 31–12–64	Intention	Formation Tops	Shows, Tests	Status 31–12–64; Remarks
Marathon Continental, Glenhaughton No. 1	89	25° 12′ 30″ 149° 07′ 45″	Ft. 1,829 KB 1,814 GL	17–11–63 25–1–64	Ft. 9,418	Stratigraphic test on seismic anomaly	Ft. Surf. Precipice 275 Moolayember 2,012 Clematis 3,015 Rewan — Kianga 6,688 Upper Bandanna 7,420 Permian (Undiff.) 9,315 Cracow	Slight gas shows in lower Rewan Sandstones. DST 6,289–6,313′, rec. 180′ slightly gas cut mud	Plugged and abandoned
Midwood, Burketown No. 1	91	18° 03′ 43″ 139° 32′ 16″	75 KB 63 GL	17–5–64 15–8–64	3,325	Stratigraphic test of Pre - Mesozoic wedge indicated by seismic	Surf. Quaternary 90 Normanton 1,310 Blackdown 1,845 Blythesdale 2,870 Lower Proterozoic	No downhole formation tests Flow measurements taken at surface of copious artesian water from cavernous dolomite section below 3,146′ Shows: 1,260–1,320′ strong odour when toasted, dead oil	Completed as a water well
Papuan Apinaipi, Netting Fence No. 1	54	26° 56′ 05″ 138° 02′ 06″	804 KB 793 GL	20–9–64 2–12–64	6,666	Stratigraphic test of the Toko syncline section of the crest of the Netting Fence anticline	— The well drilled a Cambrian section over Proterozoic granite. The Cambrian section has not been finally subdivided	Tests: 3,518–3,744′, rec. 2,980′ of water, 6,535–6,664′ tight, 6,530–6,664′ tight, Traces of heavy brown oil in cores at 1,457′ and 4,030′	Plugged and abandoned
Phillips Sunray, Gilmore No. 1	84	25° 21′ 52″ 144° 48′ 54″	1,072 KB 1,058 GL	7–6–64 9–12–64	14,260	Test Devonian–Etonvale D–4 Sandstone	Surf. Winton 1,668 Upper Tambo 2,098 Lower Tambo 2,816 Roma 3,676 Blythesdale 4,694 Walloon 4,971 Hutton 5,800 Lower Permian 6,445 Buckabie 10,546 Etonvale D–1 11,080 Etonvale D–2 11,910 Etonvale D–3 11,955 Etonvale D–4	Etonvale D–4 showed gas Tests: Open hole Lower Permian, 6,129–6,520′, rec. 4′ mud Buckabie, 6,454–6,520′, rec. 4′ mud Etonvale D–4—11,940–12,124′, GTS, 16 mins. 5·37 Mmcf/d., 12,076–12,228′, rec. 3,330′, W, 460′, WCM, 425′, GCM 12,239–12,267′, rec. 4,404′, WC, 30′, MK, GCWM	Shut-in gas well
Phillips Sunray, Quilberry No. 1	72	26° 25′ 03″ 145° 30′ 07″	1,063 KB 1,050 GL	24–11–64 ..	4,296	Test Mesozoic on seismic closure; test Palaeozoic on up-dip truncation	Surf. Tambo 747 Roma 1,670 Blythesdale 2,720 Walloon 2,930 Hutton 3,379 Palaeozoic	No shows Tests: Blythesdale 2,200–2,280′, rec. 360′ mud, 1,700′ muddy W	Drilling
Planet, Crystalbrook No. 1	81	25° 29′ 03″ 147° 59′ 35″	1,658 KB 1,647 GL	27–5–64 11–6–64	2,060	Test stratigraphic traps where Mesozoic and Permian Sediments lap onto pre-Permian basement ridge	11 Hutton 297 Evergreen 640 Precipice 956 Moolayember 1,538 Clematis 1,870 Rewan 1,998 Timbury Hills	Tests: 1,655–1,685′, rec. 1,185′ of mud and water, 1,842–1,887′, rec. 1,650′ of mud and water Shows: 1,966–1,967′, dead oil stain	Converted to a water well
Planet, Tooloombilla No. 1	81	25° 52′ 50″ 147° 57′ 40″	1,367 KB 1,358 GL	7–5–64 23–5–64	1,750	Stratigraphic test of small seismic high	Surf. Blythesdale 230 Injune Creek 490 Hutton 980 Evergreen 1,290 Precipice 1,520 Moolayember 1,748 Granite Porphyry	Tests: 1,040–1,090′, rec. 600′ muddy water, 1,409–1,470′, water to surface	Plugged and abandoned
Planet, Warrinilla No. 2	100	25° 03′ 33″ 148° 33′ 10″	979 KB 962 GL	16–10–64 28–11–64	5,810	Stratigraphic	Surf. Rewan 1,021 Bandanna 2,513 Peawaddy 3,242 Catherine 3,417 Inglelara 3,620 Aldebaran 4,340 Cattle Creek 5,540 Pre-Cattle Creek	Tests: Peawaddy 2,523–2,648′, 744 Mcf/d. Aldebaran 3,620–3,655′, rec. 210′ GCM 4,033–4,058′, rec. 630′ GCW 4,165–4,230′, rec. 600′ GCW Cattle Creek 5,750–5,810′, rec. 1,100′ GCM	Plugged and abandoned

Planet, Warrong No. 1	81	25° 09′ 46″ 147° 53′ 37″	2,052 KB 2,043 GL	14–6–64 28–7–64	3,573	Test Stratigraphic traps where Mesozoic and Permian sediments lap onto a pre-Permian basement ridge	Surf. Precipice .. .. 515 Moolayember 1,382 Clematis 1,713 Rewan 1,840 Bandanna 2,369 Peawaddy 2,404 Dry Creek 2,589 Early Storms 2,768 Lower Carboniferous to Upper Devonian 3,508 Undiff, Carboniferous	Tests: 2,602–2,652′, rec. 440′, water and mud, 3,505–3,573′, rec. 120′ mud	Plugged and abandoned
Union Kern–A.O.G., Alton No. 1 ..	57P	27° 56′ 18″ 149° 22′ 18″	725 KB 712 GL	26–6–64 18–8–64	7,328	Test Evergreen–Precipice – Wandoan formations and Permian on seismic high	Surf. Roma .. .. 2,682 Blythesdale 4,911 Walloon 5,452 Hutton 5,942 Evergreen–Precipice–Wandoan 6,855 Kianga 7,062 Back Creek 7,277 Pre-Permian basement	Tests: 6,060–6,120′, GTS, 5 mins., OTS, 30 mins. flowed 1,150 B/D, 54·5° API, 440 Mcf/d. 6,820–6,853′, GTS, 32 mins. 25 Mcf/d., rec. 100′, GCM, and 120 strong GCM and Crude 7,166–7,328′, rec. 60′ drilling mud with trace dark green crude 6,834–6,854′ Tests (through perforations): 6,834–6,854′ (after frac.) GTS, 2 hrs. 20 mins. est. 20 Mcf/d., rec. 200′ gassy mud and 1,400′ load oil 6,148–6,154′, rec. 290′ mud and 1,846′ fresh water 6,213–6,218′, rec. 140′ mud and 656′ fresh water 6,064–6,124′, flowed 480 B/D 32/64″ choke	Completed as an oil producer
Union Kern–A.O.G., Boggo Creek No. 1	57	27° 34′ 13″ 149° 08′ 35″	969 KB 955 GL	26–1–64 13–2–64	6,257	Test of Evergreen–Precipice-Wandoan formations on Wunger high	Surf. Roma .. .. 2,335 Blythesdale 4,498 Walloon 5,150 Hutton 5,590 Evergreen 5,980 Wandoan 6,238 Timbury Hills	Tests: 5,868–5,880′, rec. 685′ sl. gassy fresh water 5,753–5,740′, rec. 2,620′ sl. gassy fresh water Shows: 5,751–5,755′, oil in core 5,870–5,873′, fluorescence, trace cut, odour	Plugged and abandoned
Union Kern–A.O.G., Booroondoo No. 1	57	27° 52′ 23″ 150° 21′ 24″	879 KB 867 GL	8–1–64 23–1–64	5,834	Test of Precipice Sandstone in Stratigraphic trap	Surf. Roma .. .. 1,185 Blythesdale 3,321 Walloon 4,258 Hutton 4,940 Evergreen 5,345 Precipice 5,640 Back Creek	No significant shows	Plugged and abandoned
Union Kern–A.O.G., Brigalow Creek No. 1	57	27° 37′ 03″ 150° 20′ 12″	933 KB 921 GL	22–12–63 8–1–64	5,777	Test of Precipice Sandstone on seismic high	Surf. Roma .. .. 1,160 Blythesdale 3,214 Walloon 4,303 Hutton 4,956 Evergreen 5,435 Precipice 5,733 Pre-Artesian	Test: 5,527–5,496′, rec. 4,890′ fresh water	Plugged and abandoned
Union Kern–A.O.G., Cherwondah No. 1	57	26° 16′ 11″ 149° 55′ 09″	1,122 KB 1,110 GL	22–12–64 ..	4,598	Test of Evergreen and Precipice Sands on seismic high	Surf. Walloon .. .. 2,165 Hutton 2,990 Evergreen 3,503 Precipice 3,918 Wandoan	Tests: 4,174–4,188′, rec. estimated 250 Mcf/d. gas 4,174–4,201′, GTS, 10 mins., rec. 10′ rat-hole mud	Drilling
Union Kern–A.O.G., Colgoon No. 1 ..	57	27° 07′ 52″ 148° 55′ 19″	829 KB 815 GL	16–2–64 27–2–64	4,873	Test of Evergreen–Precipice-Wandoan formations on seismic high	Surf. Roma .. .. 1,415 Blythesdale 3,272 Walloon 3,915 Hutton 4,419 Evergreen 4,827 Granite	Tests: 4,699–4,715′, rec. 100 Mcf/d. gas, net rise 243′, GCM 4,741–4,873′, rec. 30′ drilling mud	Plugged and abandoned
Union Kern–A.O.G., Condamine No. 1 ..	57	27° 01′ 58″ 150° 17′ 52″	1,062 KB 1,050 GL	12–10–64 30–10–64	5,015	Test of Lower Precipice Sandstone in possible Stratigraphic trap on W. flank of Undulla nose	Surf. Blythesdale .. .. 1,714 Walloon 3,135 Hutton 3,890 Evergreen 4,408 Precipice 4,740 Back Creek 4,966 Kuttung	Tests: 4,676–4,643′, rec. 4,300′ fresh water 4,572–4,599′, rec. 3,986′ fresh water Shows 4,576′ fluor., odour, cut	Plugged and abandoned

TABLE 1-3—continued

EXPLORATION DRILLING—continued

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Dates Spud Rig Release	T.D. or P.D. at 31–12–64	Intention	Formation Tops	Shows, Tests	Status 31–12–64; Remarks
Union Kern–A.O.G., Conloi No. 1 ..	57	26° 25′ 42″ 149° 57′ 48″	Ft. 1,520 KB 1,508 GL	11–8–64 6–9–64	Ft. 6,005	Test of Evergreen–Precipice-Wandoan formations on seismic high	Ft. Surf. Blythesdale .. .. 1,008 Walloon 3,135 Hutton 3,918 Evergreen 4,490 Precipice 4,938 Wandoan 5,815 Cabawin	Tests: 5,335–5,304′, rec. 50′ mud 4,935–4,965′, rec. 4,275′ brackish water 4,605–4,570′, rec. 500′ muddy fr. water 4,311–4,325′, rec. 3,520′ 29·5° API gravity oil Production Test: 4,313–4,321′, pumped 29·5° crude at rate of 400 B/D, level static at 160′ from surface Shows: 4,310–4,360 fluorescence, trace cut 4,570–4,610′, fluorescence, trace cut 4,939–5,815′, scattered fluorescence, trace cut	Completed as an oil producer (pumping) Shut in and suspended
Union Kern–A.O.G., Cooloomala No. 1	57	27° 03′ 09″ 150° 16′ 09″	1,094 KB 1,082 GL	12–5–64 29–5–64	4,992	Stratigraphic test of Precipice Sandstone	Surf. Roma .. .. 600 Blythesdale 2,200 Walloon 3,466 Hutton 4,227 Evergreen 4,695 Precipice 4,963 Back Creek	Test: 4,822–4,836′, rec. net rise 4,289′ fresh water Show: 4,825–4,836′, fluorescence, odour stain cut	Plugged and abandoned
Union Kern–A.O.G., Crowder E. No. 1	57	27° 53′ 28″ 150° 17′ 10″	872 KB 860 GL	15–4–64 28–4–64	5,544	Stratigraphic test of Evergreen and Precipice Sandstones on Crowder nose	Surf. Roma .. .. 1,321 Blythesdale 3,398 Walloon 4,363 Hutton 4,895 Evergreen 5,292 Precipice 5,478 Kuttung	Tests: 5,359–5,375′, rec. 390′ sl. gassy fresh water 5,330–5,360′, rec. 2,170′ sl. gassy fresh water Shows: Evergreen showed fluorescence Precipice showed fluorescence, odour, cut and stain	Converted to a water well
Union Kern–A.O.G., Crowder N. No. 1	57	27° 51′ 43″ 150° 14′ 40″	866 KB 854 GL	3–3–64 15–3–64	5,707	Stratigraphic test of Precipice Sandstone	Surf. Roma .. .. 1,426 Blythesdale 3,520 Walloon 4,482 Hutton 5,050 Evergreen 5,438 Precipice 5,636 Kuttung	Test 5,609–5,629′, rec. 4,470′ fresh water Shows: 5,345′ and 5,375′, fluorescence, cut 5,619–5,629′, fluorescence, odour, cut	Plugged and abandoned
Union Kern–A.O.G., Crowder S. No. 1 ..	57	27° 54′ 16″ 150° 16′ 53″	870 KB 858 GL	15–3–64 25–3–64	5,300	Test Precipice on closure on Crowder nose	Surf. Roma .. .. 1,243 Blythesdale 3,350 Walloon 4,200 Hutton 4,750 Evergreen 5,165 Precipice 5,274 Kuttung	No significant shows No tests	Plugged and abandoned
Union Kern–A.O.G., Dockerill No. 1 ..	57	27° 50′ 39″ 150° 17′ 18″	844 KB 832 GL	8–2–64 22–2–64	6,009	Test of Precipice Sandstone in Stratigraphic trap, Crowder – Weir Trend	Surf. Roma .. .. 1,395 Blythesdale 3,592 Walloon 4,575 Hutton 5,152 Evergreen 5,585 Precipice 5,872 Lower Permian	Test: 5,780–5,790′, rec. 1,400′ sl. gassy fresh water	Converted to a water well
Union Kern–A.O.G., Dulacca No. 1 ..	57	26° 33′ 17″ 149° 52′ 34″	1,195 KB 1,183 GL	25–11–64 11–12–64	6,469	Test of Evergreen and Precipice Sandstones on seismic high	Surf. Blythesdale .. .. 1,504 Walloon 3,560 Hutton 4,590 Evergreen 5,080 Precipice 5,350 Wandoan	Test: 5,197–5,213′, rec. 120′ gassy watery mud, 240′ muddy water, 4,430′ gassy fresh water with scum of oil Shows: 5,190–5,220′, fluorescence, trace cut at 5,200′, straw cut at 5,205′ and 5,213′	Plugged and abandoned
Union Kern–A.O.G., Giligulgul No. 1 ..	57	26° 22′ 21″ 149° 56′ 52″	1,462 KB 1,450 GL	6–9–64 30–9–64	6,117	Test of Evergreen–Precipice-Wandoan formations on seismic high	Surf. Blythesdale .. .. 682 Walloon 2,820 Hutton 3,665 Evergreen 4,180 Precipice 4,620 Wandoan *5,555 Cabawin*	Tests: 4,280–4,262′, rec. 525′ fresh water 4,892–4,906′, rec. 180′ mud 4,914–4,890′, rec. 180′ mud 4,284–4,319′, rec. 3,620′ fresh water	Converted to a water well

Union Kern–A.O.G., Goodar Road No. 1	57	27° 55′ 38″ 150° 16′ 07″	826 KB 814 GL	29–4–64 11–5–64	5,479	Test of Precipice and Evergreen Sandstones on Crowder nose	Surf. Roma 1,214 Blythesdale 3,426 Walloon 4,180 Hutton 4,852 Evergreen 5,232 Precipice 5,435 Kuttung	Tests: 5,255–5,380′, rec. 277′ sl. gassy muddy fresh water 5,411–5,479′, rec. 127′ sl. oily watery mud Shows: Precipice showed fluorescence, cut, odour and stain	Plugged and abandoned
Union Kern–A.O.G., Gurulmundi No. 1	57	26° 25′ 50″ 150° 03′ 56″	1,203 KB 1,191 GL	30–10–64 13–11–64	4,784	Test of Evergreen–Precipice-Wandoan formations on seismic high	Surf. Walloon 2,245 Hutton 3,062 Evergreen 3,618 Precipice 4,105 Wandoan 4,410 Cabawin	Tests: 3,759–3,784′, rec. net rise 3,300′ fresh water 3,317–3,349′, rec. net rise 90′ mud Shows: 3,310–3,350′, fluorescence, trace cut 3,320′ odour 3,762′, 3,768′, 3,785′, fluorescence and cut	Plugged and abandoned
Union Kern–A.O.G., Iminbah No. 1 ..	57	27° 52′ 10″ 150° 15′ 07″	866 KB 854 GL	3–4–64 15–4–64	5,677	Stratigraphic test of Precipice and Evergreen Sandstones on Crowder–Weir trend	Surf. Roma 1,387 Blythesdale 3,446 Walloon 4,330 Hutton 5,012 Evergreen 5,396 Precipice 5,590 Kuttung	Tests: 5,466–5,487′, rec. 4,947′ sl. gassy fresh water 5,565–5,677′, rec. 1,160′ sl. gassy fresh water Shows: 5,477–5,487′, fluorescence, odour, trace to pale straw cut 5,584–5,586′, flouresence, pale straw cut	Plugged and abandoned
Union Kern–A.O.G., Lawson No. 1 ..	57	27° 06′ 56″ 150° 24′ 59″	1,102 KB 1,090 GL	29–5–64 11–6–64	5,413	Stratigraphic test of Precipice Sandstone and Evergreen Sands on Cabawin trend	Surf. Blythesdale 2,227 Walloon 3,600 Hutton 4,305 Evergreen 4,835 Precipice 5,130 Kianga	No significant shows	Plugged and abandoned
Union Kern–A.O.G., Marmadua No. 1 ..	57	27° 25′ 18″ 150° 35′ 24″	1,170 KB 1,158 GL	1–10–64 12–10–64	4,931	Stratigraphic test of Precipice Sandstone	Surf. Blythesdale 2,216 Walloon 3,399 Hutton 4,093 Evergreen 4,653 Precipice 4,802 Lower Precipice 4,864 Kuttung	No significant shows	Plugged and abandoned
Union Kern–A.O.G., Miles Creek No. 1	57	27° 00′ 46″ 150° 19′ 35″	1,049 KB 1,037 GL	23–2–64 3–3–64	4,389	Stratigraphic test of Precipice Sandstone on Cabawin trend	Surf. Blythesdale 1,402 Walloon 2,910 Hutton 3,632 Evergreen 4,114 Precipice 4,272 Back Creek 4,367 Kuttung	Shows: Evergreen showed SWC, 4,016–4,028′, yellow fluorescence trace to straw cut	Plugged and abandoned
Union Kern–A.O.G., Minnabilla No. 1 ..	57	27° 55′ 31″ 150° 15′ 23″	827 KB 815 GL	5–7–64 18–7–64	5,526	Stratigraphic test of Precipice Sandstone on Crowder–Weir trend	Surf. Roma 1,310 Blythesdale 3,510 Walloon 4,364 Hutton 4,890 Evergreen 5,306 Precipice 5,481 Kuttung	Test: 5,374–5,390′, rec. 250′ gassy watery mud with scum of oil, and 3,120′ gassy fresh water Shows: 4,800′, 4,845′, 5,050′, fluorescence 5,376–5,383′, odour, stain, fluorescence straw cut	Plugged and abandoned
Union Kern–A.O.G., Moombah No. 1 ..	57	27° 56′ 00″ 149° 07′ 50″	713 KB 699 GL	3–3–64 15–3–64	5,835	Test of Evergreen–Precipice-Wandoan formations on seismic high	Surf. Roma 2,522 Blythesdale 4,360 Walloon 4,856 Hutton 5,332 Evergreen 5,446 Wandoan 5,764 Timbury Hills	No significant shows	Plugged and abandoned
Union Kern–A.O.G., Mundagai No. 1 ..	57	27° 41′ 51″ 150° 25′ 30″	946 KB 934 GL	25–1–64 8–2–64	5,863	Test of Precipice Sandstone on seismic high, on Crowder – Weir trend	Surf. Roma 1,187 Blythesdale 3,241 Walloon 4,336 Hutton 5,105 Evergreen 5,500 Precipice 5,773 Kuttung	No significant shows	Plugged and abandoned
Union Kern–A.O.G., Myall Creek No. 1	57	27° 04′ 36″ 149° 12′ 24″	818 KB 804 GL	2–1–64 22–1–64	7,159	Test of Evergreen–Precipice-Wandoan formations and Permian in possible wedge out on S. plunging anticline	Surf. Roma 1,549 Blythesdale 3,489 Walloon 4,325 Hutton 5,068 Evergreen 5,643 Wandoan 6,098 Cabawin 6,385 Kianga 7,093 Timbury Hills	Tests: 6,218–6,240′, rec. net rise 125′ gassy mud, 20 Mcf/d. gas 6,968–6,989′, rec. net rise of 460′ –300′ watery mud and 160′ of muddy water with scum of oil	Plugged and abandoned

TABLE 1–3—continued

EXPLORATION DRILLING—continued

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Dates Spud Rig Release	T.D. or P.D. at 31–12–64	Intention	Formation Tops	Shows, Tests	Status 31–12–64; Remarks
Union Kern–A.O.G., Picurda No. 1 ..	57	26° 56′ 00″ 150° 19′ 00″	Ft. 1,068 KB 1,056 GL	20–7–64 28–7–64	Ft. 3,995	Stratigraphic test of Precipice Sandstone on W. flank of Undulla nose	Ft. Surf. Blythesdale .. .. 1,116 Walloon 2,572 Hutton 3,320 Evergreen 3,798 Precipice 3,964 Kuttung	Shows: 3,914′, fluorescence, cut	Plugged and abandoned
Union Kern–A.O.G., Piebald No. 1 ..	57	27° 28′ 01″ 150° 38′ 52″	1,201 KB 1,189 GL	26–3–64 2–4–64	3,708	Test of Precipice Sandstone on seismic high	Surf. Blythesdale .. .. 1,748 Walloon 2,820 Hutton 3,455 Evergreen 3,602 Kuttung	No significant shows	Plugged and abandoned
Union Kern–A.O.G., Talwood No. 1 ..	57	28° 11′ 02″ 149° 20′ 10″	730 KB 717 GL	27–11–64 8–12–64	6,109	Test of Evergreen–Precipice-Wandoan formations on seismic high	Surf. Roma .. .. 2,548 Blythesdale 4,530 Walloon 4,995 Hutton 5,504 Evergreen 6,059 Granodiorite	Test: 6,030–6,109′, rec. 20′ mud	Plugged and abandoned
Union Kern–A.O.G., Tartha No. 1 ..	57	27° 37′ 23″ 150° 10′ 48″	934 KB 920 GL	24–3–64 17–4–64	7,970	Test of Precipice Sandstone and Wandoan formation on seismic high	Surf. Roma .. .. 2,000 Blythesdale 4,485 Walloon 5,665 Hutton 6,248 Evergreen 6,718 Precipice 7,170 Wandoan 7,913 Cabawin	Shows: Wandoan showed fluorescence and cut in SW cores 7,347–7,351′	Plugged and abandoned
Union Kern–A.O.G., Teelba No. 1 ..	57	28° 03′ 13″ 149° 21′ 32″	834 KB 821 GL	12–12–64 28–12–64	7,372	Test equivalent of Alton Sands in Evergreen – Precipice – Wandoan sequence on seismic high	Surf. Roma .. .. 3,043 Blythesdale 5,060 Walloon 5,581 Hutton 6,020 Evergreen–Precipice 6,307 Wandoan 6,900 Kianga 7,097 Back Creek 7,255 (?) Volcanics	No significant shows	Plugged and abandoned
Union Kern–A.O.G., Tinhut No. 1 ...	57	26° 23′ 38″ 150° 09′ 57″	1,172 KB 1,160 GL	11–12–64 21–12–64	3,467	Test of Evergreen and Precipice Sandstones on seismic high	Surf. Walloon .. .. 1,300 Hutton 2,222 Evergreen 2,653 Precipice 3,003 Back Creek	Tests: 2,653–2,729′, rec. 20′ mud 2,739–2,815′, rec. 60′ watery mud and 240′ muddy fresh water 2,856–2,872′, rec. 2,570′ fresh water 2,410–2,518′, rec. 248′ watery mud	Plugged and abandoned
Union Kern–A.O.G., Warrigabie No. 1 ..	57	27° 56′ 45″ 150° 15′ 37″	817 KB 805 GL	12–6–64 26–6–64	5,509	Stratigraphic test of Precipice Sandstone on Crowder–Weir trend	Surf. Roma .. .. 1,250 Blythesdale 3,432 Walloon 4,280 Hutton 4,808 Evergreen 5,232 Precipice 5,368 Pre-Artesian	Test: 5,261–5,284′, rec. 60′ watery mud Shows: 4,967–4,969′, fluorescence 5,267–5,284′, odour, fluorescence, trace to straw cut 5,594′, 5,358′, 5,366′, residual hydrocarbons	Plugged and abandoned
Union Kern–A.O.G., Weringa No. 1 ..	57	26° 05′ 46″ 150° 02′ 26″	1,003 KB 991 GL	13–11–64 24–11–64	4,977	Stratigraphic test of Evergreen – Precipice – Wandoan formations on wedge out on W. flank of Burunga structure	Surf. Walloon .. .. 1,032 Hutton 1,880 Evergreen 2,434 Precipice 2,845 Wandoan 3,040 Cabawin 4,360 Kianga	No significant shows	Converted to a water well
Union Kern–A.O.G., Wieambilla No. 1	57	27° 03′ 46″ 150° 26′ 18″	1,095 KB 1,083 GL	29–7–64 10–8–64	4,879	Stratigraphic test of Precipice Sandstone on E. flank of Undulla nose	Surf. Blythesdale .. .. 1,836 Walloon 3,193 Hutton 3,906 Evergreen 4,498 Precipice 4,809 Kianga	No significant shows	Plugged and abandoned

DRILLING STRING ACTIVITY IN QUEENSLAND - 1964

FIG. 1-5

COMPANY	CONTRACTOR
UNION OIL	
String 1	Santa Fe Hopper
String 2	O.D.E. Ideco 7-11
String 3	Richter Bawden Rig No.5 Oilwell 76
String 4	Australian Drilling Co. National 55
E.P.C.A.	
String 1	Richter Bawden Rig No.4 T.32
MINAD	
String 1	O.D.E. Rig No.5 National 55
String 2	Richter Bawden Rig No.2 National 55
String 3	Richter Bawden Rig No.3 T-32
String 4	Richter Bawden Rig No.4 T-32
String 5	O.D.E. T-20
String 6	Richter Bawden Rig No.5 Oilwell 76
String 7	Richter Bawden Rig No.7 Emsco 350B
String 8	Richter Bawden Rig No.1 Sullivan 300A
AMALGAMATED PETROLEUM	
String 1	Richter Bawden Oilwell 76
String 2	Richter Bawden Brewster N55
MIDWOOD	
String 1	Fonasol Emsco 160
AMOSEAS	
String 1	O.D.E. Rig No.5 National 55
AQUITAINE	
String 1	Fonasol Ideco H-525
PHILLIPS PETROLEUM	
String 1	Delta Drilling Ideal 130
String 2	Reading and Bates National 75
LONGREACH OIL LIMITED	
String 1	Richter Bawden Rig No.2 National 55
EXOIL N.L.	
String 1	O.D.E. Rig No.5 National 55
PLANET	
String 1	Richter Bawden No.1 Sullivan 300A
String 2	Australian Drilling Co. National 55

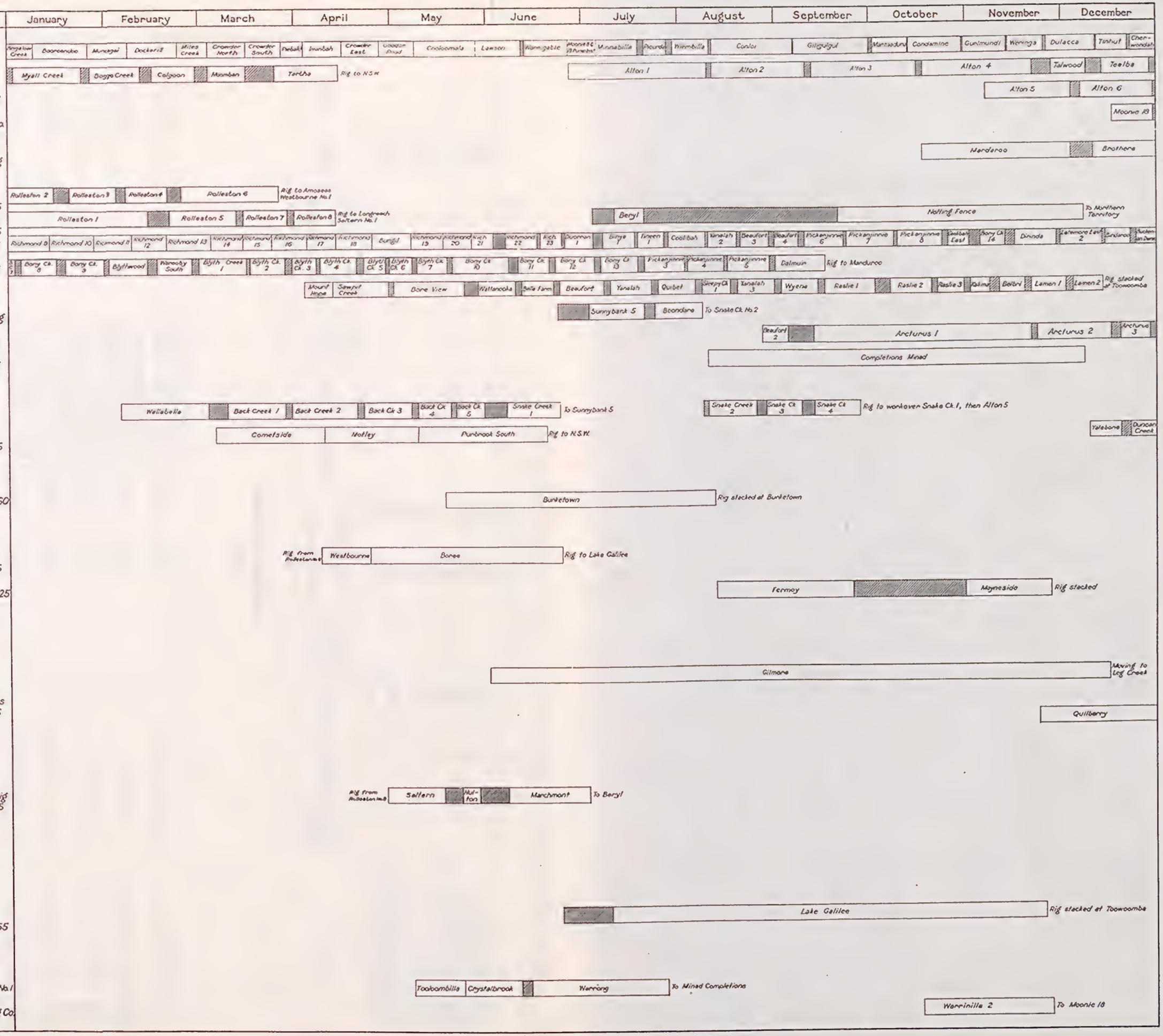


TABLE 1-3A

SCOUT DRILLING

Well	Title	Location	Latitude S. Longitude E.	Elevation	Spud Completion	T.D. (or P.D. 31-12-64)	Intention	Formation Tops	Shows, Tests	Status (31-12-64); Remarks
				Ft.		Ft.				
A.F.O., Rolleston Scouts Nos. 1-18	55/56P	7 ml. S. of Rolleston	24° 30′– 24° 38′ 148° 35′–148° 40′	680–740 GL	1–1–64 22–2–64	1,005 (max.) 500 (min.)	Structure detail crest of Rolleston Anticline	Surf.—Alluvium Rewan Bandanna	No show or test	Abandoned. Total footage: 12,017
Mid-Wood, Normanton Scout No. 2	91P	30 ml. E.N.E. of Normanton	17° 39′ 08″ 141° 31′ 38″	83 GL 85 DF	12–12–63 1–6–64	1,523	Stratigraphic	Surf. Lynd 390 Normanton 920 Quartzite	No show or test	Abandoned
Phillips–Sunray, Caboolture Scouts Nos. 1–7, 7A–14	71P	Caboolture E. to Toorbul Point	..	..	23–7–64 28–7–64	140 (max.) 40 (min.)	Stratigraphic to provide material for palynological and petrographic studies of the pre-Walloon of the Ipswich Basin	..	No show or test	Abandoned. Total footage: 1,141
Phillips–Sunray, Loamside Scouts Nos. 1, 1A–14	71P	4 ml. S. of Ipswich	..	..	29–7–64 30–7–64	220 (max.) 27 (min.)	Stratigraphic to provide material for palynological and petrographic studies of the pre-Walloon of the Ipswich Basin	.	No show or test	Abandoned. Total footage: 1,388
Phillips–Sunray, Lowood Scouts Nos. 1–2, 2A–14, 16	71P	Lowood, N.W. to Coominya	..	..	31–7–64 3–8–64	200 (max.) 20 (min.)	Stratigraphic to provide material for palynological and petrographic studies of the pre-Walloon of the Ipswich Basin	..	No show or test	Abandoned. Total footage: 1,404
Phillips–Sunray, Ma Ma Creek Scouts Nos. 3–10, 10A, 10B, 12, 12A–14	71P	Gatton–Ma Ma Creek	..	..	4–8–64 5–8–64	280 (max.) 20 (min.)	Stratigraphic to provide material for palynological and petrographic studies of the pre-Walloon of the Ipswich Basin	..	No show or test	Abandoned. Total footage: 1,596
Phillips–Sunray, Wildash Scouts Nos. 1–3, 3A–9	71P	6 ml. S.E. of Warwick	..	..	6–8–64 6–8–64	200 (max.) 60 (min.)	Stratigraphic to provide material for palynological and petrographic studies of the pre-Walloon of the Ipswich Basin	..	No show or test	Abandoned. Total footage: 1,240

TABLE 1-4

DRILLING STATISTICS

Operator	Maximum Number of Rigs Operating in Year	Exploration					Appraisal/Development					Total	
		Rig Months Drilling in Year	Footage Drilled in Year	Number of Wells Drilled in Year (Rigs Released)	Average Footage Drilled		Rig Months in Year	Footage Drilled in Year	Number of Wells Drilled in the Year (Rigs Released)	Average Footage Drilled		Footage Drilled in Year	Wells Drilled in Year
					Per Rig Month	Per Completed Well				Per Rig Month	Per Completed Well		
Amalgamated Petroleum Exploration Pty. Ltd.	2	6½	39,402	7	6,060	5,308	3¾	35,477	7	9,460	5,070	74,879	14
American Overseas Petroleum Ltd. ..	1	2½	13,648	2	5,460	6,824	..	..	..	..	..	13,648	2
Australian Aquitaine Petroleum Pty. Ltd.	1	2½	10,644	2	4,260	5,322	..	..	..	..	..	10,644	2
Condamine Oil Ltd.	1	¾	1,635	1	2,180	1,635	..	..	..	..	..	1,635	1
Exoil No Liability	1	4½	11,175	1	3,640	11,175	..	..	..	..	..	11,175	1
French Petroleum (Australia) Ltd. ..	1	2½	8,034	2	3,210	4,017	..	..	..	..	..	8,034	2
Longreach Oil Limited	1	2	13,665	3	6,830	4,555	..	..	..	..	..	13,665	3
Marathon Petroleum (Australia) Ltd.	1	1	1,458	1	1,458	..	..	..	..	..	..	1,458	1
Mines Administration Pty. Ltd. ..	5	19½	135,071	32	6,930	4,116	23	214,525	53	9,330	4,210	349,596	85
Mid-Wood Exploration Pty. Ltd. ..	1	2¾	3,325	1	1,210	3,325	..	..	..	..	..	3,325	1
Phillips Petroleum Company	2	7½	18,556	1	2,480	14,260	..	..	..	..	..	18,556	1
Planet Exploration Pty. Ltd.	1	4	13,193	4	3,300	3,300	..	..	..	..	..	13,193	4
Union Oil Development Corporation ..	4	17¾	183,820	33	10,360	5,431	5½	40,188	6	7,310	6,700	224,008	39
Totals	..	73¾	453,626	90	6,150 (Average)	5,061* (Average)	32¾	290,190	66	8,998 (Average)	4,456* (Average)	743,816	156†

* Average depth of Wells actually commenced and drilled to T.D. in year

† Includes one uncompleted development well.

TABLE 1-5

DEVELOPMENT AND APPRAISAL WELLS

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Spud Rig Release	TD or PD at 31-12-64	Shows—Tests	Status at 31-12-64; Remarks
Amalgamated Petroleum, Back Creek No. 2	55/56	26° 46′ 10″ 149° 07′ 30″	1,010 KB 997 GL	30-3-64 14-4-64	5,055	Tests ,4472–4,542′, rec. 10 ′mud 4,542–4,595′, rec. 120′ gas cut muddy water 4,812–4,856′, gas at 540 Mcf/d., rec. nil 4,856–4,876′, gas at 312 Mcf/d., rec. trace gas cut mud 4,875–4,936′, rec. 30′ mud 4,790–4,810′, rec. 700′ mud	Cased as a potential gas producer
Amalgamated Petroleum, Back Creek No. 3	55/56	26° 45′ 48″ 149° 06′ 15″	977 KB 964 GL	20-4-64 29-4-64	4,976	Tests: 4,400–4,533′, rec. 1,930′ muddy water 4,865–4,976′, rec. 30′ gas cut mud 4,699–3,976′, GTS 8 mins. of 312 Mcf/d., rec. 290′ gas cut mud	Plugged and abandoned
Amalgamated Petroleum, Back Creek No. 4	55/56	26° 46′ 50″ 149° 06′ 40″	1,037 KB 1,024 GL	6-5-64 15-5-64	5,006	Tests: 4,844–5,004′, rec. 140′ gas cut mud 4,560–4,615′, GTS 18 mins., rec. 4,460′ gassy water	Plugged and abandoned
Amalgamated Petroleum, Back Creek No. 5	55/56	26° 44′ 54″ 149° 06′ 17″	985 KB 972 GL	18-5-64 28-5-64	5,020	Tests: 4,938–5,028′, rec. 40′ oil and gas cut sl. muddy water 4,853–5,028′, rec. 50′ gas cut watery mud 4,488–4,588′, rec. 1,030′ gassy muddy water	Plugged and abandoned
Amalgamated Petroleum, Snake Creek No. 2	55/56	26° 50′ 56″ 149° 07′ 37″	943 KB 930 GL	10-8-64 25-8-64	5,178	Tests: 5,146–5,178′, rec. 5′ mud 5,028–5,068′, GTS 1 min. at 5·6 Mmcf/d. with 120 bbl/d. condensate 4,705–4,753′, 10′ mud recovered	Completed as a gas producer
Amalgamated Petroleum, Snake Creek No. 3	55/56	26° 49′ 20″ 149° 07′ 35″	993 KB 980 GL	29-8-64 9-9-64	5,253	Tests: 5,060–5,150′, GTS 5 mins. at 100 Mcf/d. with condensate, rec. 560′ dark-green oil 5,070–5,115′, gas at 50–150 Mcf/d. died, rec. 560′ dark-green oil and water 4,714–4,754′, GTS 20 mins. at 5 Mcf/d., rec. 1,970′ gassy brackish water	Plugged and abandoned
Amalgamated Petroleum, Snake Creek No. 4	55/56	26° 49′ 50″ 149° 06′ 45″	930 KB 917 GL	13-9-64 27-9-64	4,989	Tests: 4,976–4,989′, GTS 2 mins., OTS 70 mins. stab. oil flow 80 bbl/d. gas 235 Mcf/d., rec. 20·5 bbl. oil GOR 2,940′ 4,955–4,971′, GTS immediately 3·1 Mmcf/d., rec. 40′ water, 100′ condensate, 100′ gas cut mud	Completed as a gas producer
Associated Australian Oilfields, Beaufort No. 2	55/56	26° 35′ 00″ 148° 55′ 24″	1,037 KB 1,023 GL	27-8-64 5-9-64	3,845	Test 3,669–3,849′, GTS 4 mins. at 676 Mcf/d., rec. 230′ gas cut mud	Cased as a potential gas producer
Associated Australian Oilfields, Beaufort No. 3	55/56	26° 34′ 30″ 148° 54′ 35″	1,046 KB 1,035 GL	20-8-64 29-8-64	3,820	Test 3,617–3,820′, GTS 6 mins. at 824 Mcf/d., rec. 60′ mud	Cased as a potential gas producer
Associated Australian Oilfields, Beaufort No. 4	55/56	26° 34′ 55″ 148° 53′ 49″	1,006 KB 995 GL	31-8-64 7-9-64	3,856	Test 3,690–3,854′, GTS at 189 Mcf/d., rec. 130′ mud	Plugged and abandoned
Associated Australian Oilfields, Blyth Creek No. 2 ..	55/56	26° 37′ 40″ 148° 57′ 30″	1,006 KB 995 GL	16-3-64 27-3-64	3,975	Tests: 3,780–3,850′, GTS 1 min. at 1–2 Mmcf/d., WTS 45 mins., rec. 430′ water 3,763–3,812′, GTS 2 mins. at 1·94 Mmcf/d., rec. 205′ gas cut mud	Cased as a potential gas producer
Associated Australian Oilfields, Blyth Creek No. 3 ..	55/56	26° 36′ 57″ 148° 56′ 59″	975 KB 964 GL	29-3-64 7-4-64	3,888	Test 3,708–3,810′, air-blow throughout, rec. 272′ watery mud	Plugged and abandoned
Associated Australian Oilfields, Blyth Creek No. 4 ..	55/56	26° 36′ 27″ 148° 56′ 59″	965 KB 954 GL	8-4-64 18-4-64	3,880	Test 3,716–3,880′, rec. 990′ water	Plugged and abandoned
Associated Australian Oilfields, Blyth Creek No. 5 ..	55/56	26° 37′ 24″ 148° 56′ 59″	982 KB 971 GL	20-4-64 28-4-64	3,933	Test 3,780–3,814′, WIP, WAB, rec. 550′ water	Plugged and abandoned
Associated Australian Oilfields, Blyth Creek No. 6 ..	55/56	26° 36′ 59″ 148° 57′ 40″	1,011 KB 1,000 GL	30-4-64 8-5-64	4,042	Test 3,859–3,909′, GIP, steady air-blow, rec. 3,810′ water	Plugged and abandoned
Associated Australian Oilfields, Blyth Creek No. 7 ..	55/56	26° 37′ 53″ 148° 58′ 00″	1,010 KB 999 GL	9-5-64 17-5-64	3,975	Test 3,802–3,826′, GIP, GAB, GTS 90 mins., RTSTM, rec. 403′ gas cut mud	Plugged and abandoned
Associated Australian Oilfields, Bony Creek No. 7 ..	55/56	26° 44′ 00″ 148° 59′ 13″	970 KB 959 GL	19-12-63 2-1-64	4,711	See Annual Report for 1963	Plugged and abandoned
Associated Australian Oilfields, Bony Creek No. 8 ..	55/56	26° 46′ 34″ 148° 58′ 18″	953 KB 942 GL	4-1-64 13-1-64	4,422	Test 4,327–4,357′, GAB, rec. 1,687′ water	Converted to a water well
Associated Australian Oilfields, Bony Creek No. 9 ..	55/56	26° 43′ 10″ 148° 58′ 49″	1,009 KB 999 GL	19-1-64 30-1-64	4,546	Test 4,285–4,337′, GTS 3 mins. at 400 Mcf/d., rec. 20′ mud	Cased as a potential gas producer

Associated Australian Oilfields, Bony Creek No. 10 ..	55/56	26° 44′ 51″ 148° 59′ 14″	961 KB 949 GL	20–5–64 29–5–64	4,444	Tests: 4,317–4,374′, GTS 2 mins. at 4·5 Mmcf/d., rec. 1′ condensate 4,378–4,446′, WIP, WAB, rec. 10′ mud	Completed as a gas producer
Associated Australian Oilfields, Bony Creek No. 11 ..	55/56	26° 45′ 44″ 148° 58′ 18″	1,009 KB 997 GL	10–6–64 18–6–64	4,520	Tests: 4,292–4,408′, GIP, GTS 2 mins. at 750 Mcf/d., WTS 30 mins. at 250 bbl/d., rec. 940′ water 4,314–4,346′, GIP, GTS 2 mins. at 380′ Mcf/d., WTS 45 mins. at 250 bbl/d., rec. 845′ water	Plugged and abandoned
Associated Australian Oilfields, Bony Creek No. 12 ..	55/56	26° 46′ 23″ 148° 59′ 44″	946 KB 934 GL	22–6–64 30–6–64	4,485	Test 4,285–4,312′, GTS 1½ mins. at 5·56 Mmcf/d. with water spray, rec. 5′ condensate and 115′ water	Completed as a gas producer
Associated Australian Oilfields, Bony Creek No. 13 ..	55/56	26° 43′ 34″ 148° 56′ 29″	943 KB 932 GL	6–7–64 18–7–64	4,360	Test 4,226–4,360′, GIP, GTS 2 mins. at 6·5 Mmcf/d., rec. 3′ of condensate	Completed as a gas producer
Associated Australian Oilfields, Bony Creek No. 14 ..	55/56	26° 43′ 36″ 148° 55′ 36″	926 KB 915 GL	5–11–64 13–11–64	4,624	Test 4,181–4,624′, WIP dying in 19 mins., NGTS, rec. 40′ mud	Plugged and abandoned
Associated Australian Oilfields, Lamen No. 2	55/56	26° 37′ 53″ 148° 58′ 40″	1,064 KB 1,053 GL	4–12–64 13–12–64	4,050	Tests: 3,918–3,944′, FIP, FAB inc. to MAB, NGTS, rec. 90′ mud 3,960–4,050′, FIP, MAB, GTS 40 mins., RTSTM, rec. 300′ mud	Converted to a water well
Associated Australian Oilfields, Pickanjinnie No. 3 ..	..	26° 35′ 13″ 149° 07′ 31″	1,080 KB 1,069 GL	20–7–64 1–8–64	4,593	Tests: 4,220–4,284′, GIP, GTS 4 mins. at 2·57 Mmcf/d., rec. 5′ GCM 4,085–4,110′, GIP, GTS 20 mins. at 14 Mcf/d., rec. 110′ GCM	Completed as a gas producer
Associated Australian Oilfields, Pickanjinnie No. 4 ..	..	26° 34′ 57″ 149° 06′ 53″	1,047 KB 1,036 GL	3–8–64 15–8–64	4,590	Tests: 4,019–4,102′, GIP, GAB, GTS ½–1 min. at 4·9 Mmcf/d., rec. 20′ GCM 4,558–4,590′, WIP, FAB inc. to MAB, rec. 10′ mud	Completed as a gas producer
Associated Australian Oilfields, Pickanjinnie No. 5 ..	..	26° 34′ 07″ 149° 06′ 29″	1,086 KB 1,075 GL	16–8–64 29–8–64	4,738	Tests: 4,325–4,351′, no blow, rec. 5′ mud 4,111–4,161′, WIP, WAB, rec. 150′ muddy water	Plugged and abandoned
Associated Australian Oilfields, Pickanjinnie No. 6 ..	..	26° 35′ 18″ 149° 08′ 54″	1,061 KB 1,050 GL	9–9–64 22–9–64	4,651	Tests: 4,220–4,250′, GTS 30 mins. at 7·48 Mmcf/d. 4,078–4,110′, GTS 1 min. at 5·1 Mmcf/d. Muddy water to surface in 25 mins. rec. 10′ muddy water 4,322–4,336′, GTS at RTSTM, rec. 20′ mud 4,082–4,108′, GTS 1 min. at 5·6 Mmcf/d., rec. nil	Completed as a gas producer
Associated Australian Oilfields, Pickanjinnie No. 7 ..	55/56	26° 34′ 32″ 149° 08′ 25″	1,077 KB 1,066 GL	23–9–64 8–10–64	4,825	Tests: 4,377–4,407′, GTS 30 mins. at RTSTM, rec. 4,300′ water 4,192–4,234′, WAB, NGTS, PSF after 50 mins., rec. 440′ mud	Plugged and abandoned
Associated Australian Oilfields, Pickanjinnie No. 8 ..	55/56	26° 36′ 50″ 149° 11′ 33″	1,084 KB 1,073 GL	11–10–64 23–10–64	4,803	Tests: 4,317–4,347′, GIP, GAB, GTS 1 min., MTS 22 mins., gas at 6·4 Mmcf/d., mud cleaning up and final flow 6·2 Mmcf/d. 4,180–4,210′, MIP, MAB, NGTS air-blow, rec. 120′ muddy water and 560′ water	Completed as a gas producer
Associated Australian Oilfields, Raslie No. 2	55/56	26° 24′ 00″ 149° 04′ 08″	1,192 KB 1,181 GL	5–10–64 20–10–64	4,120	Tests: 3,697–3,760′, WIP, WAB, GTS 47 mins. at 29 Mcf/d., rec. 10′ mud 3,814–4,112′, GIP, GTS 9 mins. at RTSTM inc. to 2 Mmcf/d., WTS 20 mins. at 8,000 BPD 3,974–4,112′, VWIP, VWAB, NGTS, rec. 180′ mud 3,817–4,112′, GIP, GTS 9 mins. at RTSTM inc. to 2·25 Mmcf/d., WTS at 960 BPD	Plugged and abandoned
Associated Australian Oilfields, Raslie No. 3	55/56	26° 29′ 48″ 149° 03′ 54″	1,179 KB 1,190 GL	22–10–64 31–10–64	4,101	Test 3,710–3,765′, FIP, FAB, GTS 10 mins. at 140 Mcf/d.	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 9 ..	55/56	26° 42′ 26″ 148° 52′ 20″	1,078 KB 1,063 GL	30–12–63 11–1–64	4,456	Test 4,174–4,226′, VWIP no blow, rec. 65′ mud	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 10 ..	55/56	26° 42′ 05″ 148° 51′ 44″	1,005 KB 994 GL	13–1–64 22–1–64	4,272	Tests: 4,047–4,117′, condensate to surface 75 mins., gas at 9 Mmcf/d., rec. 30′ oil/condensate 4,114–4,272′, GTS 3 mins. at 650 Mcf/d., OTS 50 mins. at 220 bbl/d., rec. 410′ oil 120′, oil/mud emulsion 90′ watery mud	Completed as an oil producer
Associated Australian Oilfields, Richmond No. 11 ..	55/56	26° 41′ 44″ 148° 51′ 12″	972 KB 961 GL	27–1–64 7–2–64	4,270	Tests: 4,665–4,732′, poor blow, rec. 50′ mud 4,019–4,105′, GIP, GTS 2½ mins. at 1·1–1·5 Mmcf/d., rec. 120′ GCM	Completed as a gas producer
Associated Australian Oilfields, Richmond No. 12 ..	55/56	26° 42′ 00″ 148° 51′ 49″	1,034 KB 1,023 GL	9–2–64 18–2–64	4,370	Test 4,117–4,186′, FIP, FAB, GTS in 70 mins. RTSTM, rec. 120′ muddy water and 30′ oil	Plugged and abandoned

TABLE 1–5—continued

DEVELOPMENT AND APPRAISAL WELLS—continued

Well	Title A. to P.	Latitude S. Longitude E.	Elevation	Spud Rig Release	TD or PD at 31–12–64	Shows—Tests	Status at 31–12–64; Remarks
Associated Australian Oilfields, Richmond No. 13 ..	55/56	26° 42′ 16″ 148° 52′ 51″	1,013 KB 1,002 GL	20–2–64 1–3–64	4,342	Tests: 4,098–4,152′, GTS in ½ min. at 8·1 Mmcf/d., plus condensate 4,134–4,164′, WAB, rec. 95′ muddy water 4,257–4,343′, GTS in 68 mins. at RTSTM, rec. 4,060′ water 4,120–4,137′, GTS in 1 min. at 2·7 Mmcf/d., rec. 10′ condensate	Completed as a gas producer
Associated Australian Oilfields, Richmond No. 14 ..	55/56	26° 42′ 30″ 148° 53′ 00″	974 KB 963 GL	4–3–64 13–3–64	4,289	Test 4,082–4,133′, WAB, rec. 6′ mud	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 15 ..	55/56	26° 42′ 25″ 148° 53′ 47″	971 KB 959 GL	14–3–64 22–3–64	4,221	Test 4,016–4,069′, GTS 5 mins. at RTSTM, rec. 20′ mud	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 16 ..	55/56	26° 41′ 13″ 148° 51′ 35″	980 KB 969 GL	23–3–64 3–4–64	4,200	Tests: 3,994–4,046′, GTS 2 mins. at 4·23 Mmcf/d., no recovery 4,043–4,056′, GTS 2 mins. at 5·1 Mmcf/d., rec. 10′ condensate 4,058–4,071′, WAB, rec. 30′ mud	Completed as a gas producer
Associated Australian Oilfields, Richmond No. 17 ..	55/56	26° 41′ 48″ 148° 50′ 41″	955 KB 944 GL	4–4–64 13–4–64	4,130	Test 3,990–4,132′, WIP, WAB, rec. 4′ mud	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 18 ..	55/56	26° 41′ 01″ 148° 50′ 05″	930 KB 919 GL	13–4–64 23–4–64	4,165	Test 3,920–4,165′, GTS in 1½ mins. at 5·27 Mmcf/d., plus condensate, rec. 10′ clean condensate, 1′ water	Completed as a gas producer
Associated Australian Oilfields, Richmond No. 19 ..	55/56	26° 40′ 25″ 148° 51′ 20″	963 KB 952 GL	6–5–64 14–5–64	4,220	Test 4,020–4,220′, GIP, GAB, GTS in 45 mins. at 1 Mcf/d., rec. 120′ mud	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 20 ..	55/56	26° 40′ 44″ 148° 49′ 29″	944 KB 933 GL	16–5–64 24–5–64	4,165	Test 3,962–4,020′, WIP, WAB, rec. 15′ mud	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 21 ..	55/56	26° 40′ 35″ 148° 50′ 25″	933 KB 922 GL	25–5–64 1–6–64	4,108	Test 3,901–3,938′, FIP, FAB, GTS 5 mins at 349 Mcf/d., rec. 20′ GCM	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 22 ..	55/56	26° 41′ 09″ 148° 49′ 35″	927 KB 916 GL	6–6–64 14–6–64	4,136	Test 3,974–4,142′, WIP, WAB, rec. 75′ mud	Plugged and abandoned
Associated Australian Oilfields, Richmond No. 23 ..	55/56	26° 41′ 23″ 148° 50′ 36″	935 KB 924 GL	17–6–64 22–6–64	4,104	Test 3,940–4,107′, WIP, WAB, rec. 20′ mud	Plugged and abandoned
Associated Australian Oilfields, Sunnybank No. 5	55/56	26° 56′ 35″ 149° 13′ 35″	835 KB 820 GL	3–7–64 18–7–64	6,500	Tests: 5,784–5,910′, NGTS, rec. 30′ mud 5,910–6,000′, WIP, GAB, NGTS, rec. 40′ mud 6,000–6,150′, GIP, GTS 9 mins., RTSTM decreasing, rec. 60′ mud 6,150–6,250′, WIP, WAB, steady NGTS, rec. 140′ slightly oil flecked mud 6,368–6,500′, GIP, GTS 7½ mins. at 66 Mcf/d., rec. 2,635′ GCM, oil flecked at top	Plugged and abandoned
Associated Australian Oilfields, Yanalah No. 2	55/56	26° 31′ 00″ 148° 50′ 53″	1,161 KB 1,150 GL	10–8–64 18–8–64	3,833	Tests: 3,645–3,834′, GTS in 2 mins. at RTSTM, rec. 60′ GCM 2,038′ water 3,647–3,703′, WIP, GAB, rec. 120′ mud, 180′ muddy water, 630′ water 3,706–3,834′, FIP, GTS in 45 mins at RTSTM, rec. 120′ mud, 90′ muddy water, 1,390′ water	Plugged and abandoned
Associated Australian Oilfields, Yanalah No. 3	55/56	26° 32′ 30″ 148° 51′ 43″	1,147 KB 1,136 GL	19–8–64 1–9–64	4,050	Tests: 3,734–3,820′, GIP, GTS in 2½ mins. at RTSTM, rec. 3,500′ water 3,740–3,820′, GIP, GTS in 2½ mins. at 775 Mcf/d., WTS in 45 mins. at 100 gals. per hr., rec. 675′ water 3,761–3,781′, GIP, GTS in 3 mins. at 1·39 Mmcf/d., rec. 385′ water 3,885–3,900′, FIP, GTS in 24 mins. at RTSTM, rec. 3,785′ water	Cased as a potential gas producer
Associated Freney Oilfields, Arcturus No. 2	55/56	24° 01′ 10″ 148° 24′ 42″	595 KB 584 GL	23–11–64 16–12–64	3,650	Tests: 1,700–1,749′, VWIP, VWIB, NGTS, rec. 10′ mud 1,939–2,033′, VWIP, VWAB, NGTS, rec. 15′ mud 1,853–2,070′, MIP, MAB, NGTS, rec. 736′ water 2,110–2,234′, GIP, GAB, NGTS, rec. 2,110′ water 2,674–2,706′, VWIP, VWAB, died 30 mins., NGTS, rec. 20′ mud 3,292–3,359′, MAB, died 40 mins., NGTS, rec. 10′ mud	Converted to a water well

Associated Freney Oilfields, Arcturus No. 3	55/56	24° 04′ 30″ 148° 31′ 05″	599 KB 584 GL	19–12–64 28–12–64	2,150	Tests: 1,821–1,888′, MAB GTS 4 mins. at 687 Mcf/d., rec. 120′ mud 1,714–1,754′, WIP blow increased to good after 25 mins, GTS in 44 mins. at 521 Mcf/d., rec. 50′ mud 1,888–2,116′, WIP increasing to GAB, GTS 5 mins at 328 Mcf/d., rec. 300′ mud 1,687–2,116′, GIP, GTS in 5 mins. at 1·3 Mmcf/d., rec. 120′ mud	Cased as a potential gas producer
Associated Freney Oilfields, Arcturus No. 4		24° 05′ 20″ 148° 31′ 05″	605 KB 590 GL	31–12–64 ..	PD 427	..	Drilling
Associated Freney Oilfields, Rolleston No. 2		24° 32′ 58″ 148° 38′ 48″	695 KB 679 GL	11–12–63 14–1–64	4,732	Test 4,665–4,732′, FIP, AB throughout, NGTS, rec. 30′ GCM	Plugged and abandoned
Associated Freney Oilfields, Rolleston No. 3		24° 32′ 55″ 148° 37′ 52″	698 KB 684 GL	19–1–64 3–2–64	3,250	Tests: 1,940–2,010′, GTS in 7 mins. at 517 Mcf/d., rec. 10′ mud 2,458–2,471′, no blow, rec. 5′ mud 3,020–3,102′, gas at 3·22 Mmcf/d., no recovery 3,215–3,250′, no blow, rec. 60′ mud	Cased as a potential gas well
Associated Freney Oilfields, Rolleston No. 4		24° 34′ 39″ 148° 37′ 52″	702 KB 687 GL	7–2–64 17–2–64	3,483	Tests: 2,121–2,210′, WAB, rec. 430′ water 3,399–3,500′, WAB, rec. 70′ mud	Plugged and abandoned
Associated Freney Oilfields, Rolleston No. 5		24° 33′ 47″ 148° 36′ 55″	737 KB 723 GL	20–2–64 6–3–64	3,634	Tests: 3,560–3,634′, WAB died in 5 mins., rec. 10′ mud 3,369–3,383′, WAB died in 11 mins., rec. 30′ mud	Plugged and abandoned
Associated Freney Oilfields, Rolleston No. 6		24° 35′ 27″ 148° 37′ 52″	716 KB 702 GL	24–2–64 24–3–64	5,490	Test 3,741–3,772′, WAB died in 15 mins., rec. 150′ mud	Plugged and abandoned
Associated Freney Oilfields, Rolleston No. 7		24° 32′ 53″ 148° 37′ 24″	698 KB 687 GL	14–3–64 26–3–64	3,500	Tests: 1,930–2,153′, GTS in 47 mins. at RTSTM, rec. 20′ sl. GCM 3,020–3,082′, GTS in 38 mins. at 35 Mcf/d., rec. 20′ GCM	Plugged and abandoned
Associated Freney Oilfields, Rolleston No. 8		24° 33′ 47″ 148° 38′ 48″	694 KB 683 GL	31–3–64 11–4–64	3,400	Tests: 1,940–2,066′, GIP, GTS in 2 mins. at 1 Mmcf/d., rec. 200′ mud 1,890–1,938′, WIP, WAB, died in 13 mins., rec. 50′ mud	Cased as a potential gas producer
Union–Kern–A.O.G., Alton No. 2		27° 56′ 02″ 149° 21′ 47″	726 KB 713 GL	20–8–64 10–9–64	6,139	Tests: 6,089–6,102′, GTS 5 mins., OTS 16 mins. Flowed 1,535 B/D 53° API crude and 785 Mcf/d. gas 6,094–6,102′, Production test (perforated). Flowed 2,000 B/D 54° API crude and 943 Mcf/d. gas 36/64 bean	Completed as an oil well
Union–Kern–A.O.G., Alton No. 3		27° 56′ 36″ 149° 21′ 59″	723 KB 710 GL	14–9–64 15–10–64	7,200	Tests: 6,165–6,215′, rec. 12′ mud 6,789–6,806′, GTS 5 mins. at 250 Mcf/d., rec. 90′ oily mud, 120′ clean oil 7,100–7,149′, rec. 18′ mud 6,068–6,112′, GTS in 3 mins., OTS in 65 mins. at 1,426 B/D 6,027–6,105′ (slotted). Production test flowed 1,010 B/D on 22/64 bean	Completed as an oil well
Union–Kern–A.O.G., Alton No. 4		27° 56′ 49″ 149° 22′ 25″	732 KB 719 GL	17–10–64 21–11–64	7,292	Tests: 6.083–6,113′, GTS 4 mins., OTS in 15 mins., estimated 1,200 B/D 52° API crude and 450 Mcf/d. gas 6,115–6,148′, GTS 6 mins. rate decreasing, rec. 2,600′ 52° API crude and 1,500′ fresh water 6,226–6,245′, rec. 30′ mud 7,171–7,232′, rec. 15′ mud 6,070–6,089′ (slotted). Production test 2,000 B/D 53° API crude and 700 Mcf/d. gas on 32/64 bean and 800 B/D 53° API crude and 280 Mcf/d. gas on 18/64 bean	Completed as an oil producer
Union–Kern–A.O.G., Alton No. 5		27° 57′ 11″ 149° 22′ 10″	718 KB 704 GL	6–11–64 3–12–64	6,925	Tests: 6,090–6,118′, GTS in 3 mins., OTS in 15 mins., estimated rates 1,100 B/D 51·6° API crude 6,133–6,181′, GTS 8 mins., estimated 50 Mcf/d. gas decreasing, rec. gas and 500′ muddy fresh water 6,894–6,873′, rec. 70′ mud 6,111–6,094 (slotted). Production test flowed 850 B/D 52° API crude on 22/64 bean and 388 Mcf/d. gas	Completed as an oil producer
Union–Kern–A.O.G., Alton No. 6		27° 56′ 25″ 149° 21′ 32″	727 KB 713 GL	6–12–64 30–12–64	6,805	Tests: 6,052–6,084′, rec. 40′ slightly gassy mud 6,049–6,135′, rec. 40′ slightly gassy mud 6,168–6,183′, GTS in 4 mins., OTS in 30 mins. Flowed 52° API crude at 1,000 B/D, 400 Mcf/d. gas 6,538–6,494′, rec. 100′ mud 6,772–6,805′, rec. 60′ mud 6,165–6,181 (slotted). Production test flowed 1,000 B/D 52° API crude on 32/64 bean	Completed as an oil producer
Union–Kern–A.O.G., Moonie No. 18		27° 45′ 10″ 150° 15′ 14″	891 KB 876 GL	17–12–64 30–12–64	5,827	Test 5,648–5,703′, rec. 832′, 50° API crude and 166′ water	Awaiting completion as an oil producer

TABLE 1–6
GEOLOGICAL SURVEYS BY GOVERNMENT AGENCIES

Area	Sedimentary Basin	Type	Agency	Party Months
Eddystone 1 : 250,000 area	Bowen, Surat	Regional Survey	BMR–GSQ	5
Duaringa–St. Lawrence–Tambo 1 : 250,000 areas	Bowen	Regional Survey	BMR–GSQ	5
Longreach–Maneroo–parts of Jericho–Galilee–Buchanan 1 : 250,000 areas	Eromanga	Regional Survey	BMR–GSQ	5
Maryborough 1 : 250,000 area	Maryborough	Regional Survey	GSQ	3
Monto 1 : 250,000 area	Bowen, Surat, Yarrol	Regional Survey	GSQ	3
Bauhinia Downs–Theodore–Taroom (Baralaba–Taroom–Mundubbera 1 : 250,000 areas)	Bowen	Shallow drilling for palynological studies. Total 87 holes, 3,561 ft.	GSQ	3
Tambo–Springsure–Eddystone–Taroom–Mundubbera 1 : 250,000 areas	Bowen, Surat	Shallow drilling in support of regional mapping. Total 25 holes, 4,241 ft.	BMR	½
Longreach–Jericho–Galilee 1 : 250,000 areas	Eromanga	Shallow drilling in support of regional mapping. Total 10 holes, 1,920 ft.	BMR	½
			TOTAL	25

TABLE 1–7
GRAVITY SURVEYS
By Petroleum Companies

Title	Operator	Contractor	Locality	Crew Months	Area Covered	Stations Observed
					Sq. Mls.	
81P	Alliance Oil Development Australia N.L.	United Geophysical Corporation	Chesterton	1·0	174	174
96P	Australian Oil Corporation	Operator	Julia Creek	3·5	600	233
P.P.P. 708	Condamine Oil Ltd.	Wongela Geophysical Pty. Ltd.	Chinchilla	1·0	100	134
102P	Farmout Drillers No Liability	Namco International Incorporated	Barcaldine	0·5	90	461
66/67P	French Petroleum Company (Aust.) Pty. Ltd.	Compagnie Generale de Geophysique	Bedourie	10·0	5,130	2,153
			Total by Petroleum Companies	16·0	..	3,155

By Government Agencies

Basin	Agency	Operator	Locality	Type	Crew Months	Area Covered	Stations Observed
						Sq. Mls.	
Great Artesian, Bowen, Surat, Maryborough and Ipswich	Bureau of Mineral Resources	Wongela Geophysical Pty. Ltd.	South-east Queensland—(Jundah Thargomindah–Brisbane, Bundaberg)	Helicopter	4½	180,000	3,116
Great Artesian, Bowen, Surat, Maryborough and Ipswich	Bureau of Mineral Resources	Wongela Geophysical Pty. Ltd.	As above	Ground Traverses (stations ±4m. apart) to provide control for helicopter survey	5	4,570 miles of traverse	1,157
Adavale	Bureau of Mineral Resources	Compagnie Generale de Geophysique	Blackall, Adavale, Augathella, Quilpie, Charleville	Ground surveys along Phillips Petroleum Coy. seismic traverses	4	14,000	2,705
				Total by Government Agencies	13½	..	6,978
				TOTAL	29½	..	10,133

TABLE 1-8

AEROMAGNETICS

By Petroleum Companies

Title	Operator	Contractor	Locality	Area Covered	Line Miles Flown
95P ..	Australian Aquitaine Petroleum Pty. Ltd. ..	Adastra Hunting Geophysics Pty. Ltd.	Cape York	Sq. Mls. 15,200	4,945
90P ..	Australian Gulf Oil Company	Aero Service Limited	Great Barrier Reef ..	41,400	17,408
58P ..	Marathon Petroleum Australia Ltd.	Adastra Hunting Geophysics Pty. Ltd.	Gulf of Carpentaria	20,128	12,063
				Total	34,416

By Government Agencies

Basin	Agency	Operator	Locality	Area Covered	Line Miles Flown
Georgina ..	Bureau of Mineral Resources	Geology and Geophysics	Lawn Hill, Camooweal, Mt. Whelan 4M sheets	Sq. Mls. 18,900	10,900
				Total	45,316

TABLE 1–9

SEISMIC SURVEYS

By Petroleum Companies

Title	Operator	Contractor	Locality	Crew Months	Type and Method of Survey R. Reconnaissance D. Detail C.P. Continuous Profiling R.P. Reversed Profiling	Area Surveyed (Square Miles)	Length of Sub-surface Section (Miles)	Number of Shot Points	Number of Holes Drilled	Total Footage Drilled	Explo-sives Used	Detona-tors Used
											Lb.	
98P	Alliance Oil Development Australia N.L.	Namco International Incorporated ..	Trinidad ..	3·0	Reflection; D; C.P. ..	500	92	298	492	30,000*	5,000*	330*
55/56P	Amalgamated Petroleum Exploration Pty. Ltd.	Austral Geoprospectors Pty. Ltd. ..	Combarngo ..	0·5	Refraction; R; R.P. ..	..	38	53	46	4,500*	4,500*	100*
103P	Ampol Exploration (Q'land) Pty. Ltd. ..	Western Geophysical Company of U.S.A.	Mackay ..	0·33	Reflection; D; C.P.; Marine	500	315	..	..	..	15,816	845
86P	Australian Aquitaine Petroleum Pty. Ltd.	Compagnie Generale de Geophysique	Longreach ..	5·25	Reflection; C.P.	420	193	613	1,662	158,109	82,427	2,099
					Refraction; R.P.	..	103	129				
66/67P	Delhi Australian Petroleum Ltd. ..	United Geophysical Corporation ..	Haddon Corner	2·0	Reflection; C.P.; R.; D. ..	820	164	492	498	61,675	40,670	764
66/67P	French Petroleum Company (Aust.) Pty. Ltd.	Compagnie Generale de Geophysique	Bedourie ..	10·0	Reflection; R.; C.P. ..	5,130	828	2,234	43,841	725,188	192,021	49,558
					Refraction	..	35	88	Surface	Shooting	35,000	400
75P	Marathon Petroleum Australia Ltd. ..	Geophysical Service International ..	Longreach ..	3·6	Reflection; R.; C.P. ..	105	106	422	1,443	103,783	31,450	1,742
83P	Marathon Petroleum Australia Ltd. ..	Petty Geophysical Engineering Company	Isisford ..	4·2	Reflection; R.; C.P. ..	1,006	222	895	1,180	189,960	57,170	2,341
104P	Marathon Petroleum Australia Ltd. ..	Western Geophysical Company of U.S.A.	Torres Strait ..	1·0	Reflection; R.; C.P. (Marine)	1,944	618	1,700	..	..	90,142	1,753
55/56P	Mines Administration Pty. Ltd.	Austral Geoprospectors Pty. Ltd. ..	Muckadilla–Yuleba	5·0	Reflection; C.P.	475	249	995	995	145,790	17,480	1,426
55/56P	Mines Administration Pty. Ltd. ..	Austral Geoprospectors Pty. Ltd. ..	Sunnybank–Wallumbilla	6·75	Reflection; C.P.	550	326	1,307	1,334	182,995	21,560	1,703
55/56P	Mines Administration Pty. Ltd.	Geophysical Service International ..	Emerald ..	3·6	Reflection; C.P.	650	130	493	1,759	93,198	29,939	1,890
55/56P	Mines Administration Pty. Ltd.	Seismograph Services Limited	Emerald ..	2·0	Reflection; C.P. (Vibroseis)	600	58	540	..	..	..	..
55/56P	Mines Administration Pty. Ltd.	United Geophysical Corporation ..	Mackenzie ..	1·1	Reflection; C.P.	..	..	..	..	..	..	..
					Refraction; R.P.; R. ..	1,100	60	181	299	19,580	11,425	369
55/56P	Mines Administration Pty. Ltd.	Austral Geoprospectors Pty. Ltd. ..	Arbroath–Richmond	5·0	Reflection; C.P.	600	308	1,136	1,197	159,536	28,095	1,977
71P	Phillips Petroleum Company	Austral Geoprospectors Pty. Ltd. ..	Cecil Plains ..	1·8	Reflection; C.P.	240	70	292	870	121,765	5,525	1,132
71P	Phillips Petroleum Company	Austral Geoprospectors Pty. Ltd. ..	Caboolture–Gatton	0·8	Reflection; inline offset ..	..	..	..	83	10,395	18,425	383
84P	Phillips Petroleum Company	Petty Geophysical Engineering Co. ..	Gilmore ..	2·3	Reflection; D.; C.P. ..	144	69	208	665	85,235	17,260	706
84P	Phillips Petroleum Company	United Geophysical Corporation ..	Adavale ..	2·7	Reflection; R.; C.P. ..	576	127	382	1,168	122,005	53,990	1,265
81P	Planet Exploration Pty. Ltd.	Austral Geoprospectors Pty. Ltd. ..	Crystalbrook ..	1·0	Reflection; R.; C.P. ..	100	25	87	324	49,037	22,000	1,102
					Refraction; R.; R.P. ..	..	19	45	..	..	..	..
70P	Shell Development (Australia) Pty. Ltd.	Western Geophysical Company of U.S.A.	Hervey Bay ..	0·13	Reflection; R.; C.P. (Marine)	..	183	492	..	..	24,688	492
99P	L. H. Smart Oil Exploration Co. Ltd. ..	Geophysical Associates Pty. Ltd. ..	Eromanga ..	3·21	Reflection; R.; C.P. with skips	1,500	182	517	557	77,540	23,064	685
					Refraction							
57P	Union Oil Development Corporation ..	United Geophysical Corporation ..	Moonie ..	7·5	Reflection; R.; D.; C.P. ..	8,500	480	1,639	1,660	397,896	99,172	2,775
57P	Union Oil Development Corporation ..	United Geophysical Corporation ..	Flinton ..	9·5	Reflection; R.; D.; C.P. ..		736	2,296	2,291	437,164	101,877	3,754
57P	Union Oil Development Corporation ..	United Geophysical Corporation ..	Surat Shelf ..	7·0	Reflection; R.; D.; C.P. ..		503	1,574	1,544	354,989	84,716	2,897
		Totals by Petroleum Companies ..	..	89·27	..	25,500	6,284					

* Approximate Figures

By Government Agencies

Basin	Agency/Operator	Locality	Crew Months	Type and Method of Survey	Area Surveyed	Length of Sub-surface Section	Number of Shot Points	Number of Holes Drilled	Total Footage Drilled	Explo-sives Used	Detona-tors Used
					Sq. Mls.	Miles				Lb.	
Georgina	Bureau of Mineral Resources, Geology and Geophysics	Boulia–Bedourie ..	7·0	Reflection; D.; C.P. ..	..	96	667	4,118	214,960	28,000	4,395
				Refraction; D.; R.P.; 4 profiles	..	29	52				
	Totals by Government Agencies	..	7·0	..	..	125					
		TOTAL	96·27	..	25,500	6,409					

FIGURE 1-6

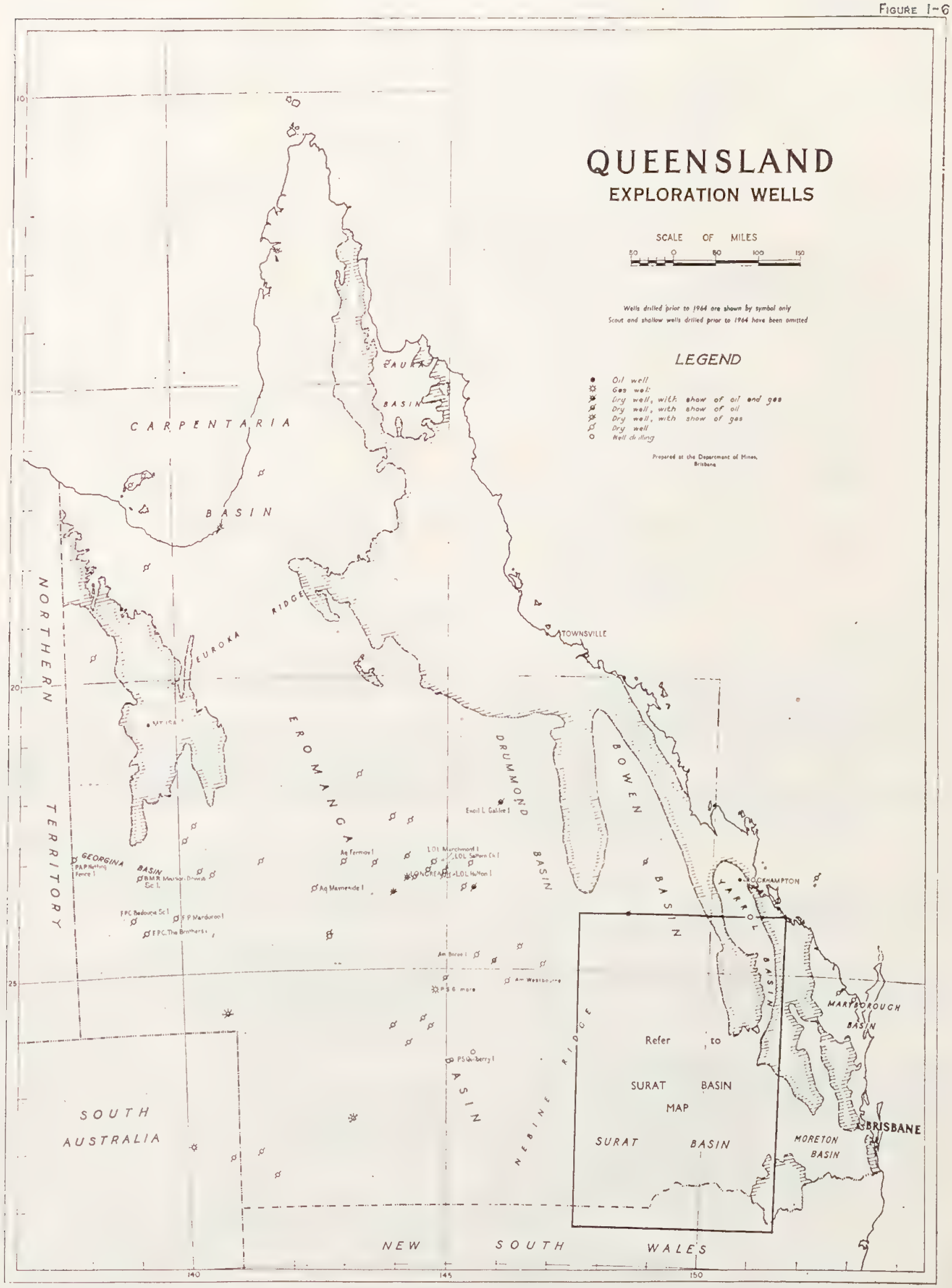

QUEENSLAND
EXPLORATION WELLS
SCALE OF MILES
50 0 50 100 150
Wells drilled prior to 1964 are shown by symbol only
Scout and shallow wells drilled prior to 1964 have been omitted
LEGEND
Oil well
Gas well
Dry well, with show of oil and gas
Dry well, with show of oil
Dry well, with show of gas
Dry well
Well drilling
Prepared at the Department of Mines, Brisbane
CARPENTARIA BASIN
GAUPA BASIN
NORTHERN TERRITORY
EUROKA
MT ISA
EROMANGA BASIN
DRUMMOND BASIN
BOWEN BASIN
TOWNSVILLE
ROCKHAMPTON
GEORGINA BASIN
PAP Notting Fence 1
BMR Marion Downs Sc 1
FPC Bedourie Sc 1
F P Marduroo 1
F P C The Brothers 1
Ag Fermoy 1
Ag Mameside 1
LONGREACH
LOL Marchmont 1
LOL Salmon Ck 1
LOL Hutton 1
Enoil L Galilee 1
Am Boree 1
Am Westbourne
PSG more
PSG Quilberry 1
NEBINE RIDGE
SOUTH AUSTRALIA
NEW SOUTH WALES
Refer to SURAT BASIN MAP
SURAT BASIN
MARYBOROUGH BASIN
MORETON BASIN
BRISBANE
10
15
20
25
140
145
150

FIGURE 1-7

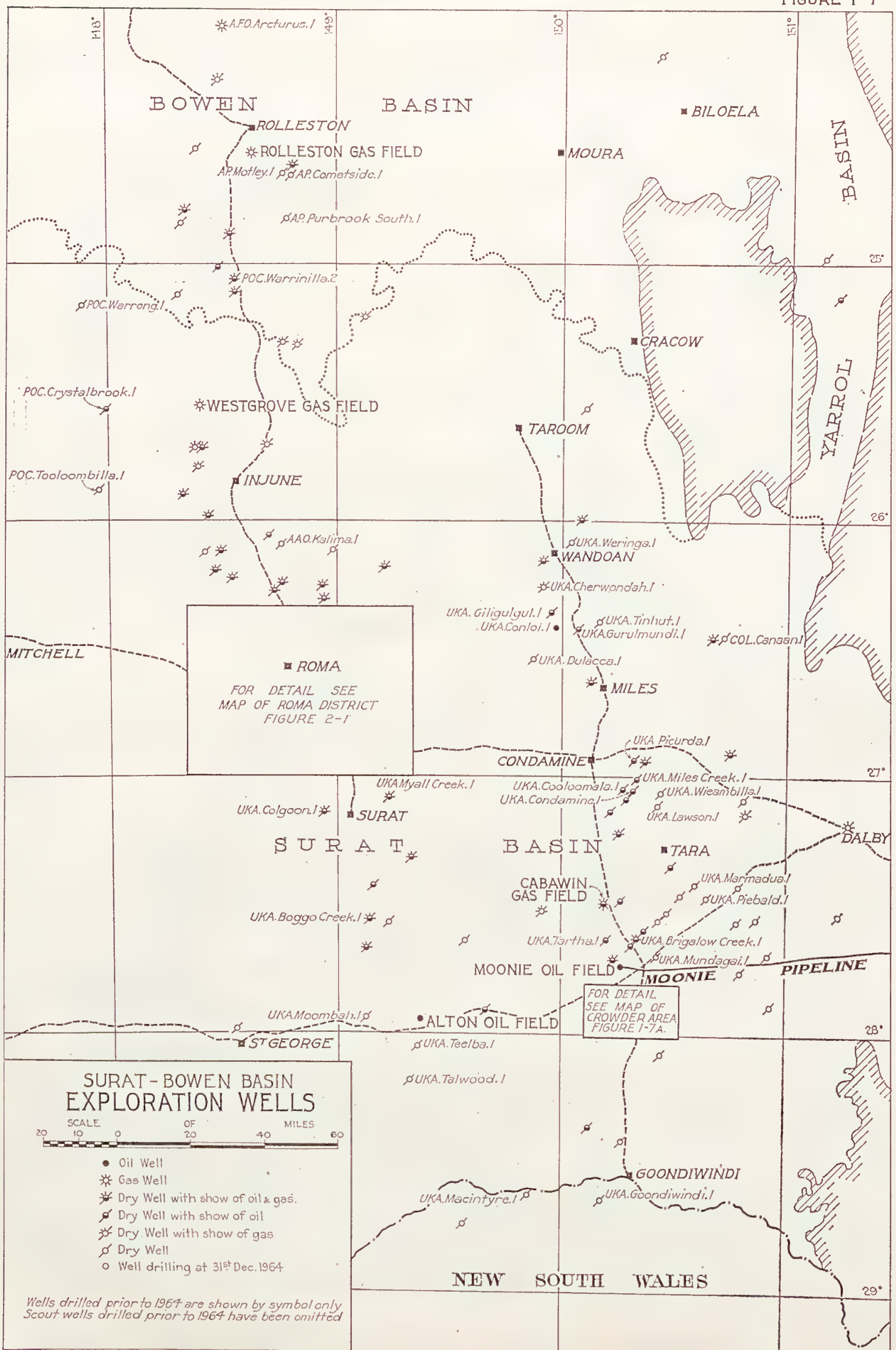
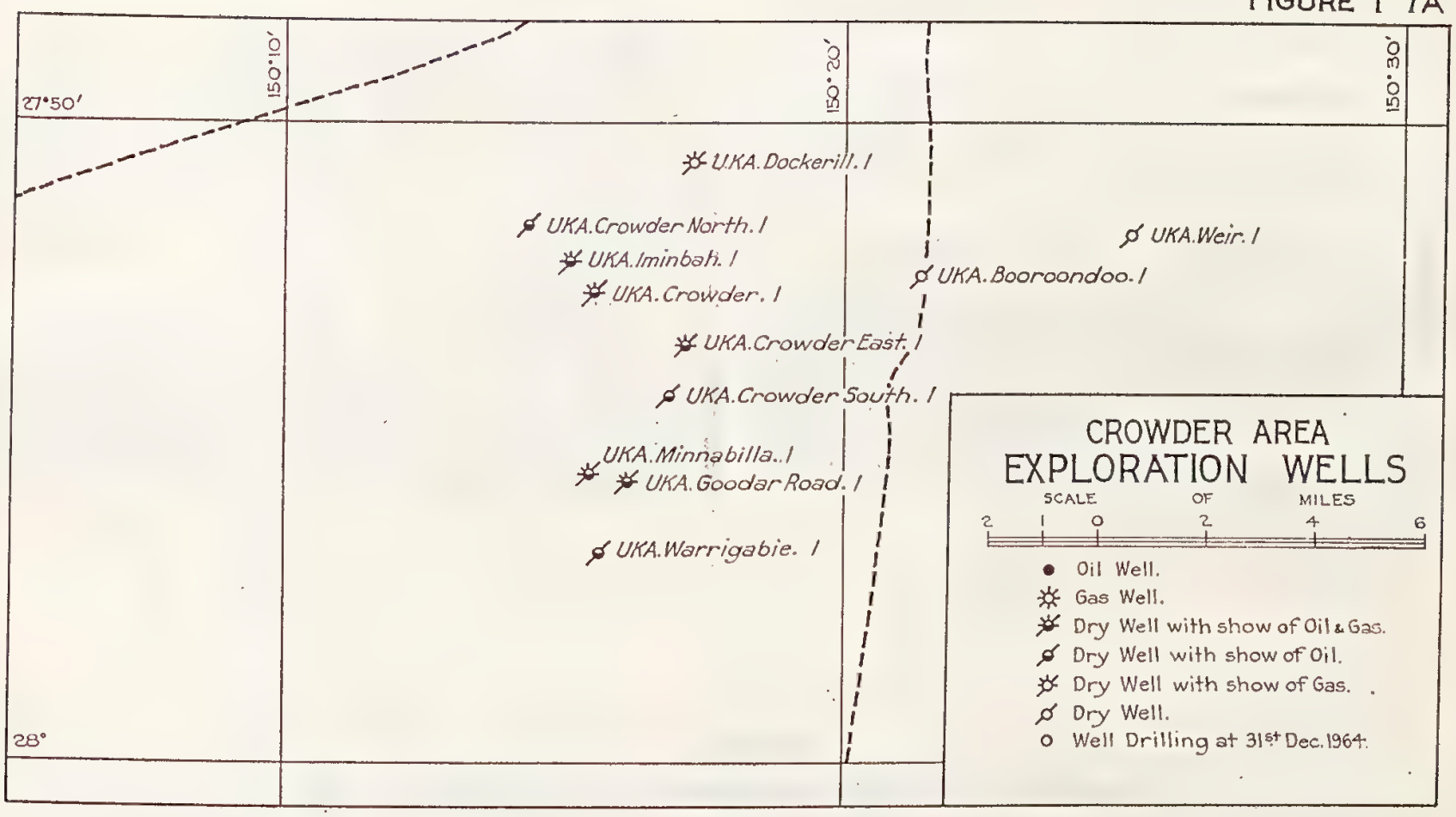

148°
149°
150°
151°
25°
26°
27°
28°
29°
BOWEN BASIN
SURAT BASIN
BASIN
YARROL
A.F.O.Arcturus.1
ROLLESTON
ROLLESTON GAS FIELD
A.P.Motley.1
A.P.Cometside.1
A.P.Purbrook South.1
P.O.C.Warrinilla.2
P.O.C.Warrong.1
P.O.C.Crystalbrook.1
P.O.C.Tooloombilla.1
WESTGROVE GAS FIELD
INJUNE
A.A.O.Kalima.1
MITCHELL
ROMA
FOR DETAIL SEE MAP OF ROMA DISTRICT FIGURE 2-1
BILOELA
MOURA
CRACOW
TAROOM
U.K.A.Weringa.1
WANDOAN
U.K.A.Cherwondah.1
U.K.A.Giligulgul.1
U.K.A.Conloi.1
U.K.A.Tinhut.1
U.K.A.Gurulmundi.1
COL.Canaan.1
U.K.A.Dulacca.1
MILES
U.K.A.Picurda.1
CONDAMINE
U.K.A.Miles Creek.1
U.K.A.Cooloomala.1
U.K.A.Condamine.1
U.K.A.Wieambilla.1
U.K.A.Lawson.1
U.K.A.Myall Creek.1
U.K.A.Colgoon.1
SURAT
TARA
DALBY
CABAWIN GAS FIELD
U.K.A.Marmadua.1
U.K.A.Piebald.1
U.K.A.Boggo Creek.1
U.K.A.Tartha.1
U.K.A.Brigalow Creek.1
U.K.A.Mundagai.1
MOONIE OIL FIELD
MOONIE PIPELINE
FOR DETAIL SEE MAP OF CROWDER AREA FIGURE 1-7A.
U.K.A.Moombah.1
ALTON OIL FIELD
ST GEORGE
U.K.A.Teelba.1
U.K.A.Talwood.1
GOONDIWINDI
U.K.A.Macintyre.1
U.K.A.Goondiwindi.1
NEW SOUTH WALES
SURAT-BOWEN BASIN
EXPLORATION WELLS
SCALE OF MILES
20 10 0 20 40 60
Oil Well
Gas Well
Dry Well with show of oil & gas.
Dry Well with show of oil
Dry Well with show of gas
Dry Well
Well drilling at 31st Dec. 1964
Wells drilled prior to 1964 are shown by symbol only
Scout wells drilled prior to 1964 have been omitted

FIGURE 1-7A



2. DEVELOPMENT AND PRODUCTION

2–1 Union-Kern-A.O.G.

Queensland's first oilfield at Moonie went onto continuous production in February, 1964, with daily production building up slowly during the initial months to a maximum of 5,700 bbls/day averaged during the month of August and declining slightly thereafter to average 5,215 bbls/day during the rest of the year.

Minor difficulties were encountered in maintaining the water content of the shipped crude below the contracted shipping cut of 0·5 per cent. B.S. & W. as water production increased steadily towards the middle of the year, but installation of chemical injection facilities overcame this problem.

Production from the 56·4 Upper Precipice sand present in the first three dual completion wells, Moonie No. 1, Moonie No. 2, and Moonie No. 17, in the centre of the field proved disappointing and could only be sustained throughout the year from Moonie No. 2. Further wells are programmed to be drilled to this sand in 1965 and a secondary recovery project is planned.

Lower Precipice flank wells Moonie No. 8 and Moonie No. 13, neither of which were capable of sustained natural flow due to high water cuts were converted to pumping wells during the year, but went off production immediately. Of these wells Moonie No. 8 still awaits repair while Moonie No. 13 was cleaned out and put back on the pump at the end of December.

A further flank well, Moonie No. 9, which had also declined steadily due to increasing water cut, was converted to a pumping well in December and was ready to recommence production at the end of the year.

Moonie production is delivered to the Brisbane terminal through the Moonie pipeline, construction of which was completed early in 1964. (See 5–0.)

Drilling continued on the Alton field 60 miles west-south-west of Moonie where commercial production was first obtained from a 23 ft. sand in the Evergreen Shales at a depth of 6,100 ft. in July. Since then, five further appraisal wells have been drilled on a half mile grid and all have proved productive.

The proved area is as yet small, however, and further outstepping is required to delineate the field prior to finalising plans to tie the field in by pipeline to Moonie.

2–2 Associated Group

During the year, the Associated Group maintained an intensive appraisal and development programme in the Roma and Rolleston areas.

Close to Roma, the Richmond and Bony Creek structures were fully appraised, and a further 6 wells were drilled in the Pickanjinnie gas field. Additional limited gas reserves were also established at Beaufort, Blyth Creek, Lamen, Raslie and Yanalah.

Intermittent production of crude from wells Richmond Nos. 1, 5 and 10 to supply the Roma Power House proved recoverable reserves of oil to be very limited. Richmond 1 went off production after producing only 8,940 bbls. of oil and Richmond 10 showed a rapid decline in production and will now probably be recompleted on the upper gas bearing sand in the Precipice after a cumulative production of only 578 bbls. Richmond 5 which is completed on this same upper sand has produced 958 bbls. of 48° API crude, but the high gas-oil ratio in this well points to this being condensate production from the main gas reservoir.

Continued appraisal to the north-west disclosed the extent of the Richmond gas reserve to be disappointingly small and Bony Creek remains the only gas reserve of any size in the area, with the Pickanjinnie reserve, a dual prospect in the Precipice and the Showgrounds sandstone, of a comparable

size to that of the Richmond reserve. Reserve figures given in Table 2–2 have been based on the most recent information available to the Department at the end of 1964.

Open flow potential and deliverability studies are now being undertaken in all fields in the Roma area to enable future production performance to be predicted. Figures given in Table 2–2 will therefore be subject to revision when results of these studies have been received.

In the Rolleston area, discovery well Rolleston 1 was completed after proving commercial gas production in both the Early Storms and Mantuan sands with encouraging sand development in both of these sands. Appraisal of the structure proved disappointing however and only 2 further potential gas wells were completed out of a total of 8 wells drilled in the field. A second but smaller reserve has more recently been discovered at Arcturus, 20 miles N.N.W. of Rolleston where two out of a total of four wells drilled have proved gas in a well developed sand in the Bandanna.

2–3 Amalgamated Petroleum

Two small fields have been discovered at Back Creek, and Snake Creek, close to Roma, where gas has been found in the Showgrounds sandstone.

Two of the Back Creek wells have been completed as potential gas wells and three wells in Snake Creek, which was drilled on a farmout from the Associated Group and is now a joint Associated/Amalgamated operational area, are also potential producers.

Neither field is of any great extent however, and reserves of gas are limited.

2–4 Phillips Petroleum

A promising gas reserve possibly of considerable size has been discovered at Gilmore near Adavale where Phillips Gilmore No. 1 tested gas in the Devonian D–4 sands. The well has now been completed on the prospective sands and testing is in progress. Further appraisal drilling and testing will however be required before the full extent of this reserve can be properly assessed.

TABLE 2–1

SUMMARY OF PROVEN OIL RESERVES AT 31st DECEMBER, 1964

Company	Field	Reservoir	Stock Tank Oil in 1,000's of Barrels		
			Initial Recoverable Reserve	Cumulative Production	Remaining Recoverable Reserve
Associated	Richmond	Precipice	144	8·9	135
Union–Kern	Alton	Evergreen	4,372	..	4,372
	Moonie	Precipice	25,028	1,487·1	23,541
	Other Fields	..	152	..	152
		TOTALS	29,696	1,496·0	28,200

TABLE 2–2

SUMMARY OF PROVEN GAS RESERVES AT 31st DECEMBER, 1964

Company	Field	Reservoir	S.C.F. of Gas in Millions of Cubic Feet		
			Initial Recoverable Reserve	Cumulative Production	Remaining Recoverable Reserve
Amalgamated Petroleum ..	Back Creek–Snake Creek	Showground	6,645	48·5	6,596
Associated Group	Bony Creek	Precipice	29,436	51·7	29,384
	Richmond	Precipice	10,794	30·1	10,764
	Other Fields, Roma Area	..	25,669	332·5	25,337
	Rolleston Area	..	28,259	49·0	28,210
Phillips Petroleum	Gilmore	Devonian	99,000	2·3	98,998
Union–Kern	Cabawin	Kianga	897	..	897
		TOTALS	200,700	514·1	200,186

NOTES: (1) Associated Group figures exclude reserves and production from Glentulloch and Hospital Hill.

(2) Phillips Gilmore reserve must be classified as a probable reserve. Testing of the discovery well is still in progress.

TABLE 2–3

ANNUAL OIL PRODUCTION REPORT—YEAR 1964

Company (Operator)	Field	Reservoir	Total Production for Year			Cumulative Production to End of Year				Status of Field Wells at Year End													
										Number of Producing Wells Closed in								Other Wells				Totals
			Oil Barrels	Water Barrels	Gas Mcf.	Oil Barrels	Water Barrels	Gas Mmcf.	Number of Wells on Production	Available	High BSW	High GOR	Not Connected	Awaiting Investigation	Awaiting Workover	B.H.P.	Observation	Observation	Injection	Suspended	Abandoned	
Mines Administration Pty. Ltd.	Richmond	Precipice	9,796	150	29,526	10,476	150	35·665	Nil	2	..	..	..	1	..	..	..	..	..	..	4	7
	Sunnybank	Rewan ..	..	..	..	70	..	0·150	Nil	..	..	..	..	1	..	..	..	..	..	..	4	5
Sub-Total	..	..	9,796	150	29,526	10,546	150	35·815	..	2	..	..	..	2	..	..	..	..	..	..	8	12
Union Oil	Alton ..	Evergreen	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	6
	Conloi ..	Evergreen	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
	Moonie ..	56·4 sand	58,792	415	5,051	58,792	415	5·051	2	..	..	..	..	1	..	..	..	..	..	..	..	3*
		58·0 sand	1,428,265	12,962	361,991	1,428,265	12,962	361·991	13	..	..	..	..	2	..	..	2	..	..	..	..	17
Sub-Total	..	..	1,487,067	13,377	367,042	1,487,067	13,377	367·042	15	..	..	..	7	3	..	..	2	..	..	..	..	27
Totals ..	..	..	1,496,863	13,527	396,568	1,497,613	13,527	402·857	15	2	..	..	7	5	..	..	2	..	..	..	8	39

* Dual completions MN–1, MN–2, MN–17

TABLE 2–4

ANNUAL GAS PRODUCTION REPORT

Company	Field	Reservoir	Total Production for Year			Cumulative Production to End of Year			Status of Field Wells at Year End											
										Number of Producing Wells Closed In							Other Wells				
			Gas Mmcf.	Condensate Bbls.	Water Bbls.	Gas Mmcf.	Condensate (Oil) Bbls.	Water Bbls.	Number of Wells on Production	Available	B.S.W.	Not Connected	Awaiting Investigation	Awaiting Workover	B.H.P.	Observation	Observation	Injection	Suspended	Abandoned	Total
Amalgamated Petroleum	Back Creek ..	Showground	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	3	5
	Snake Creek ..	Showground	48·45	..	..	48·45	..	..	..	..	..	3	..	..	..	..	..	..	..	1	4
	Sub-Total ..	..	48·45	..	..	48·45	..	..	..	..	..	3	..	..	..	..	..	..	2	4	9
Associated Group	*Roma Area*																				
	Beaufort ..	Precipice ..	1·50	..	..	1·50	..	..	..	..	..	1	..	..	..	..	..	..	2	1	4
	Blyth Creek ..	Precipice ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	5	7
	Bony Creek ..	Precipice ..	46·20	30	..	51·75	30	..	..	..	..	8	..	..	..	..	..	..	1	5	14
	Hospital Hill ..	Precipice ..	0·63	..	..	26·80	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1
	Lamen	Precipice ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	2
	Pickanjinnie ..	Precipice ..	..	..	..	29·89	..	..	..	..	..	2	..	..	..	..	..	..	..	..	2
		Showground	15·00	..	..	15·00	..	..	..	..	..	3	..	..	..	..	..	..	..	3	6
	Raslie	Precipice ..	13·80	..	..	13·80	..	..	..	..	..	1	..	..	..	..	..	..	2	2	3
	Richmond ..	Precipice ..	30·13	25	..	30·13	25	..	..	..	..	6	..	..	..	..	..	..	1	10	17
	Timbury Hills	Precipice ..	101·13	190	..	265·89	391	..	1	..	..	..	..	..	..	..	..	..	..	..	1
	Yanalah ..	Precipice ..	6·40	..	..	6·40	..	..	..	..	..	1	..	..	..	..	..	..	1	1	3
	Sub-Total ..	..	214·79	245	0	441·16	446	..	2	..	..	22	..	..	..	..	..	..	8	28	60
	Rolleston Area																				
	Arcturus ..	Bandanna ..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	2
	Glentulloch ..	Early Storms	..	..	..	22·16	..	1,422	..	..	..	..	..	..	..	..	..	..	..	1	1
	Rolleston ..	Mantuan ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1
		Early Storms	30·00	..	..	30·00	..	..	..	..	..	1	..	..	..	..	..	..	1	5	7
	Westgrove ..	" Unit 6 " ..	..	..	..	19·00	..	..	..	..	..	2	..	..	..	..	..	..	..	2	4
	Sub-Total ..	..	30·00	..	..	71·16	..	1,422	..	..	..	4	..	..	..	..	..	..	2	9	15
	Sub-Total ..	..	244·79	245	0	512·32	446	1,422	2	..	..	26	..	..	..	..	..	..	10	37	75
Phillips Sunray ..	Gilmore ..	Devonian D–4	2·30	..	..	2·30	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
	Grand Total	..	295·54	245	0	563·1	446	1,422	2	..	..	30	..	..	..	..	..	..	12	41	85

TABLE 2–5

ANNUAL OIL AND GAS UTILISATION STATEMENT

—	Moonie — Union Oil Development Corporation				Roma Area Gas Fields — Associated Group			
	Oil		Gas		Oil		Gas	
	Barrels	Percentage of Total	Mmcf.	Percentage of Total	Barrels	Percentage of Total	Mmcf.	Percentage of Total
Total Annual Production	1,487,067	100·0	367·04	100·0	10,041	100·0	214·79	100·0
Field Utilisation—Product Derivation	..	..	..	..	..	..	..	..
—Primary Recovery	..	..	..	..	..	..	..	..
—Secondary Recovery	..	..	..	..	..	..	..	..
—Drilling/Production	889	..	..	..	2,602	..	..	..
—Field as Fuel	431	..	..	..	..	..	..	..
Sub-Total—Field Utilisation	1,320	0·09	..	..	2,602	25·9	..	..
Sub-Total—Consumption	..	..	..	..	..	..	..	..
Operational Losses—Processing	..	..	..	..	..	..	..	..
—Gathering	2,778	1·87	..	..	240	..	..	..
—Pipeline	1,096	0·73	..	..	..	..	..	..
—Others	..	..	..	..	..	..	..	..
Sub-Total—Losses	−3,874	2·60	..	..	240	2·39	..	..
Volume Flared/Vented in Field	..	..	362·15	98·67	..	..	113·03	52·62
Change in Stocks—Field	..	..	..	..	+2,666	26·56	..	..
—Terminal	+242,302	..	..	..	..	..	..	..
Pipeline—Used as fuel	1,647	1·11	4·89	1·33	..	..	..	..
Volume Shipped/Delivered from Terminal	1,237,924	83·2	..	..	4,533	45·15	101·76	47·38

Note: (1) Includes oil produced from Richmond No. 1.

(2) An additional 80,800 Mcf. of gas were produced and flared from Wells Rolleston No. 1 and Gilmore No. 1.

FIG. 2-1

WELLS FOR PETROLEUM

ROMA DISTRICT

SCALE OF MILES

- Oil well
- Gas well
- Dry well with show of oil and gas
- Dry well with show of oil
- Dry well with show of gas
- Dry well
- Well drilling, 31-12-1964

ROMA
WARREGO
BEAUFORT
BLYTH CREEK
LAMEN
BONY CREEK
RICHMOND
PICKANJINNIE
BACK CREEK
SNAKE CREEK
HOSPITAL HILL
TIMBURY HILLS
YANALAH
RASLIE
"CONDAMINE HWY."
CARNARVON HWY.
HWY.
AAO/AP Farm-out
AAO/AP Yelebone Farm-out

FIG. 2-2

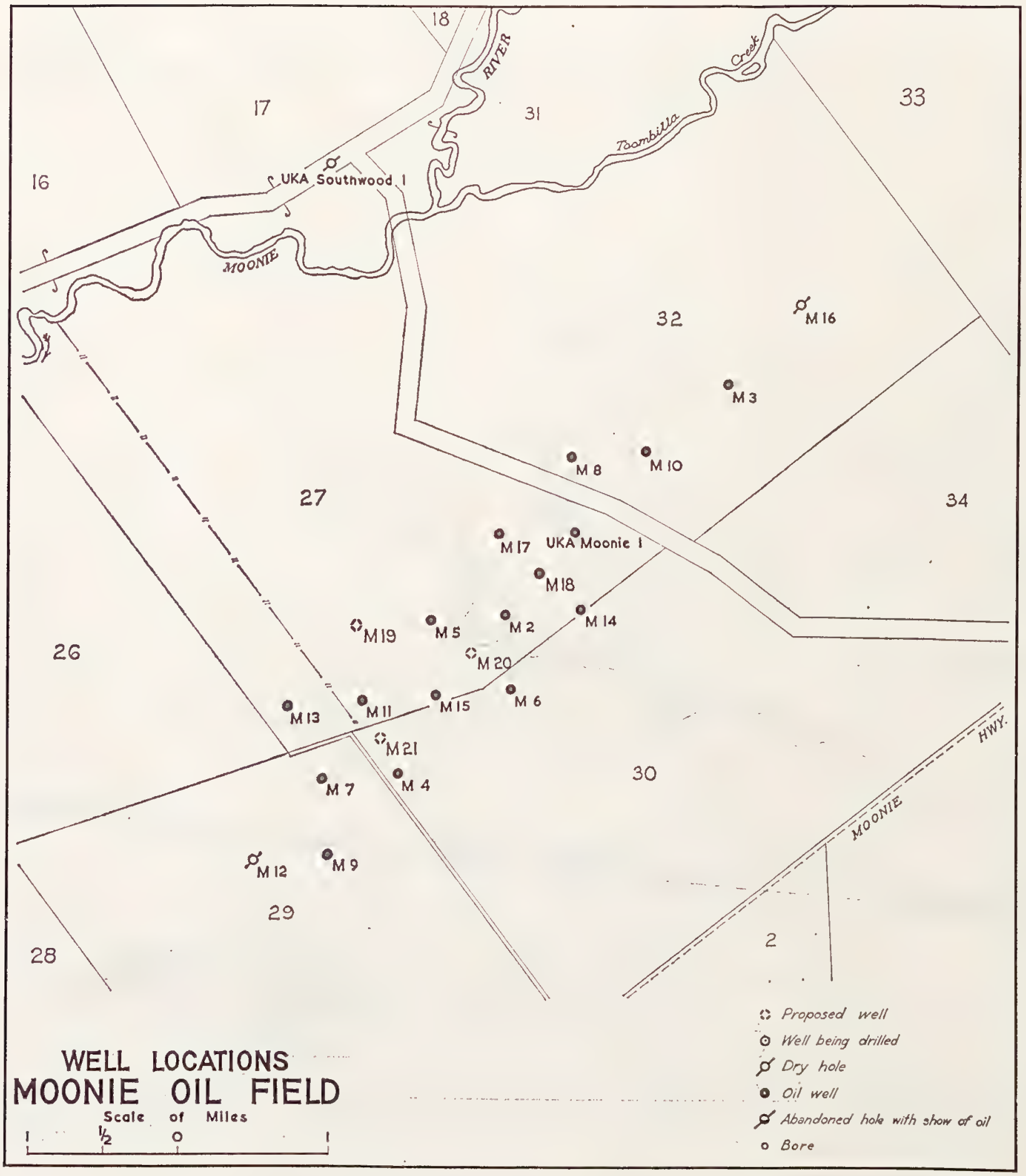
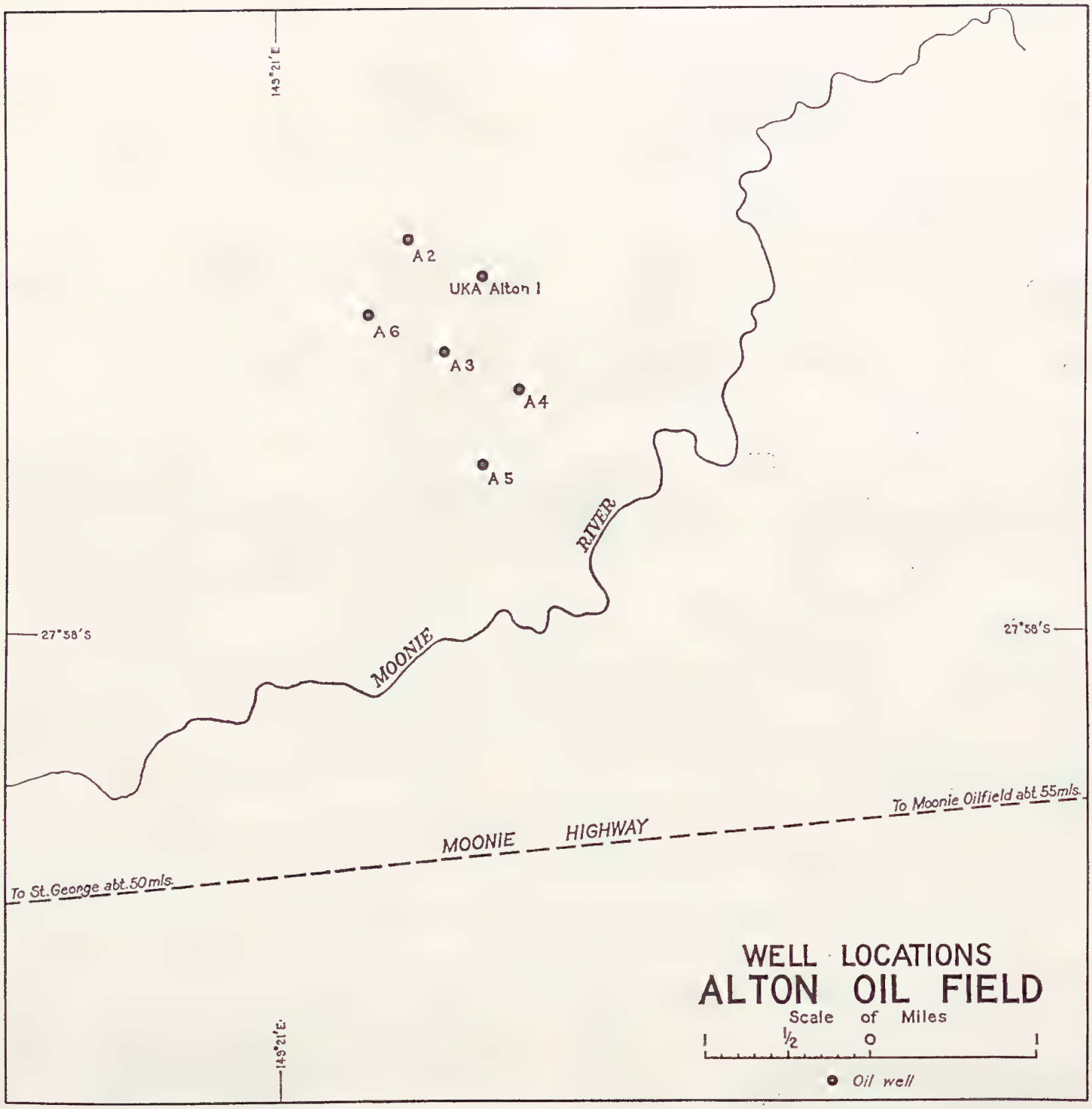
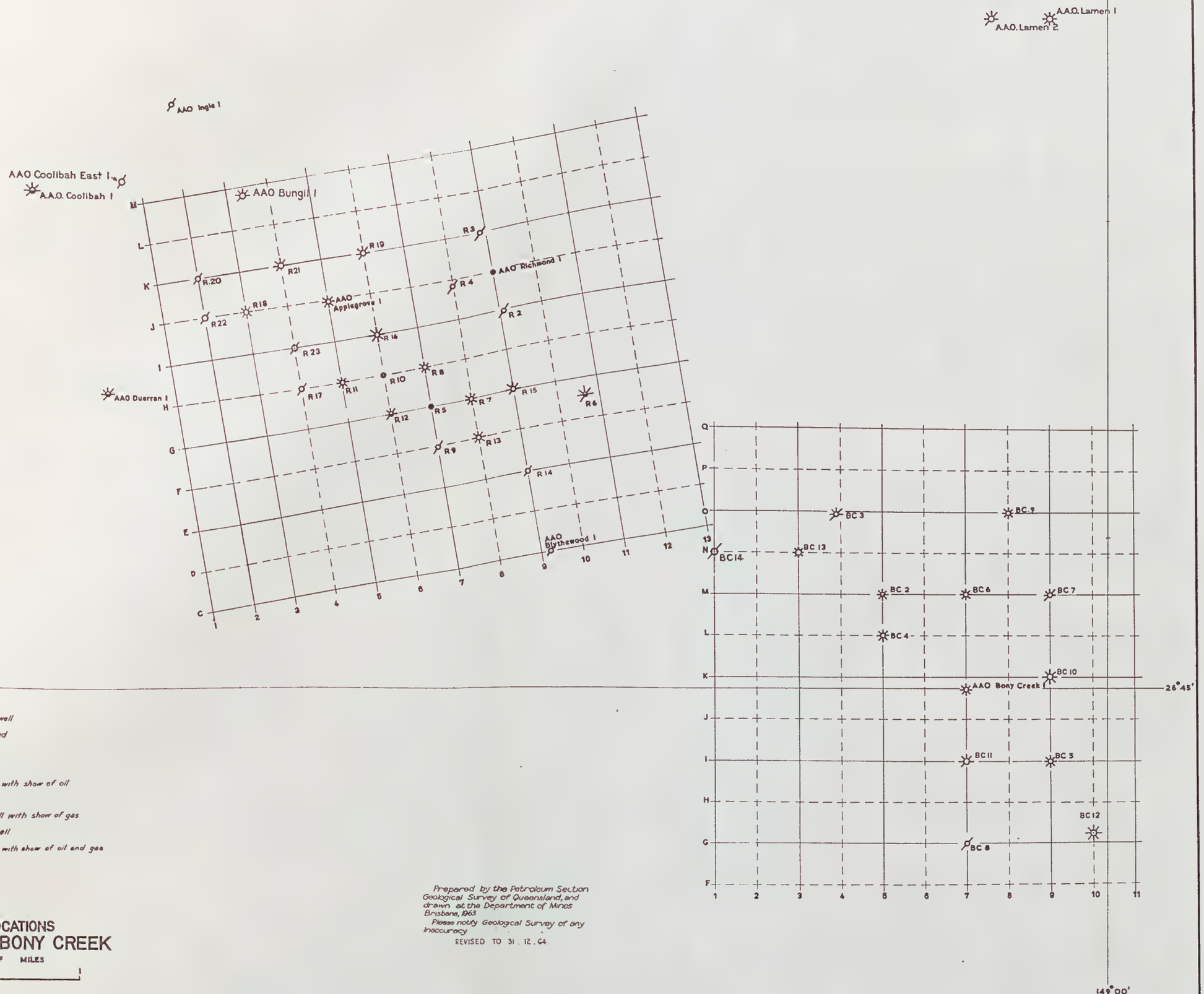

18
17
31
33
16
RIVER
Creek
Toambilla
UKA Southwood 1
MOONIE
32
M16
M3
M8
M10
27
34
M17
UKA Moonie 1
M18
M19
M5
M2
M14
26
M20
M13
M11
M15
M6
M21
M7
M4
30
HWY.
MOONIE
M12
M9
29
2
28
Proposed well
Well being drilled
Dry hole
Oil well
Abandoned hole with show of oil
Bore
WELL LOCATIONS
MOONIE OIL FIELD
Scale of Miles
1 ½ 0 1

FIG. 2-3


149°21'E
A2
UKA Alton 1
A6
A3
A4
A5
RIVER
MOONIE
27°58'S
27°58'S
To Moonie Oilfield abt. 55mls.
MOONIE HIGHWAY
To St. George abt. 50mls.
WELL LOCATIONS
ALTON OIL FIELD
Scale of Miles
1/2
0
Oil well
149°21'E



- Proposed well
- Well being drilled
- Dry hole
- Oil well
- Abandoned well with show of oil
- Gas well
- Abandoned well with show of gas
- Oil and gas well
- Abandoned well with show of oil and gas

WELL LOCATIONS
RICHMOND — BONY CREEK

SCALE OF MILES

1 ½ 0 1

Prepared by the Petroleum Section Geological Survey of Queensland, and drawn at the Department of Mines Brisbane, 1963

Please notify Geological Survey of any inaccuracy

REVISED TO 31. 12. 64.

R.J.A./T.P.K.

FIG. 2-5

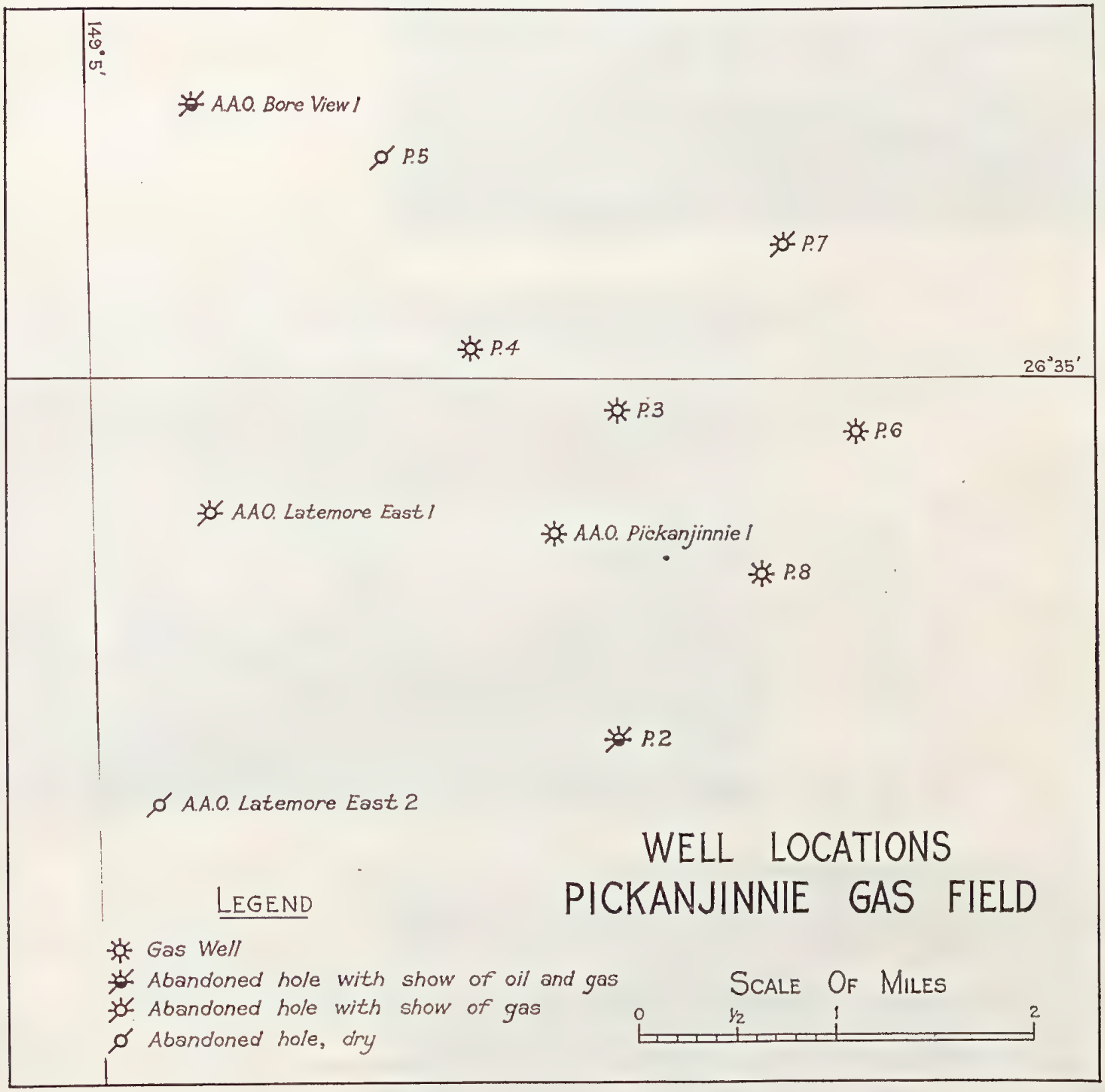
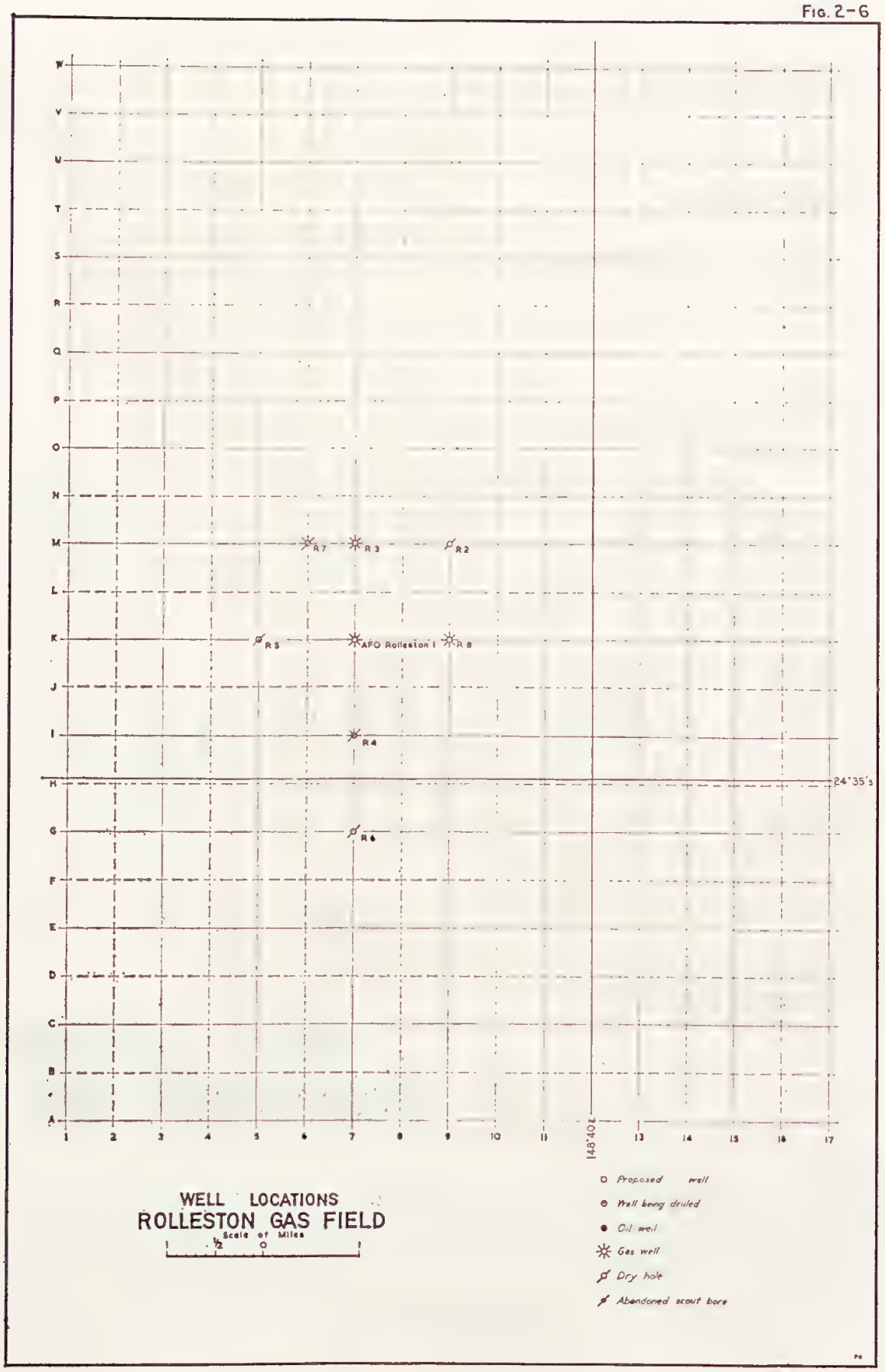

149°5'
A.A.O. Bore View 1
P.5
P.7
P.4
26°35'
P.3
P.6
A.A.O. Latemore East 1
A.A.O. Pickanjinnie 1
P.8
P.2
A.A.O. Latemore East 2
WELL LOCATIONS
PICKANJINNIE GAS FIELD
LEGEND
Gas Well
Abandoned hole with show of oil and gas
Abandoned hole with show of gas
Abandoned hole, dry
SCALE OF MILES
0
½
1
2

FIG. 2-6


W
V
U
T
S
R
Q
P
O
N
M
L
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J
I
H
G
F
E
D
C
B
A
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
R7
R3
R2
R5
AFO Rolleston 1
R8
R4
R6
24°35'S
148°40'E
WELL LOCATIONS
ROLLESTON GAS FIELD
Scale of Miles
½
0
1
Proposed well
Well being drilled
Oil well
Gas well
Dry hole
Abandoned scout bore

Pumping units and 140,000 bbl. floating roof tank at Lytton Terminal.

Midwood Burketown No. 1 Well—Emsco GB 160 Rig (Forasol).

Rigging up National Ideal 55 Rig, Longreach Oil, Marchmont No. 1 Well (near Longreach).

3. Employment and Accidents

A steady rise in employment has been evident since the year 1960, employment in the industry now standing at 881.

Routine safety inspections of drilling rigs operating in Queensland were carried out periodically during the year by departmental inspectors. Except for one isolated case in which a drilling contractor was instructed to stop operations for unsafe practice, rig maintenance and safety consciousness was generally good. In most cases requests from the inspectors for modifications in layout and equipment were dealt with promptly by operators and drilling contractors.

The main problem confronting contractors was the maintenance of vapour proof globes on lights particularly on the more mobile rigs which shift from location to location about every two weeks. Other practices which occur too frequently are spudding before being fully rigged up, auxiliary electrical lines not being suspended above the ground and inadequate protection of pump shear relief valves.

A general improvement in safety in the year 1964 compared with the year 1963 can be shown in the fact that for an increase of footage drilled of some 73 per cent. in 1964 over 1963 the total number of accidents was practically the same for both years.

Once again, however, a large percentage of the accidents were caused by handling tools and tubulars and in particular affected fingers and hands. It must be repeated therefore that operators and contractors should in their own interests, bring the need for care, especially in such operations, before all drilling crew members.

During construction of the Moonie pipeline, there were 49 lost time accidents, of which one resulted in permanent disability, for 721,367 manhours worked. Lost Time Frequency Rate was 68 accidents per million manhours worked, Severity Rate was 699 days lost per million manhours worked, and Mean Duration Rate was 32 days per accident. There were no lost time accidents during operation of the pipeline in 1964.

TABLE 3–1
EMPLOYMENT

Field														Office and Administration			Total
Geological and Geophysical Surveys				Exploration Drilling					Appraisal and Development Drilling					Operator's Employees			
Geologists and Geophysicists		Technicians and Helpers		Supervisors, Petroleum Engineers, Geologists, Toolpushers, and Drillers		Drilling Crews		Others	Supervisors, Petroleum Engineers, Geologists, Toolpushers, and Drillers		Drilling Crews		Others	Geologists and Geophysicists	Drilling	Clerical and Administration	
Employed by		Employed by		Employed by		Employed by			Employed by		Employed by						
Operator	Contractor	Operator	Contractor	Operator	Contractor	Operator	Contractor		Operator	Contractor	Operator	Contractor					
31	37	5	245	21	46	..	161	15	5	15	..	40	5	77	8	140	851
Employed by Government Agencies (approx)																	30
Total ..																	881

TABLE 3–2
CLASSIFICATION OF ACCIDENTS
(Lost Time Only)

Nature of Injuries	Occupation					Injured Members									Agency of Injury					
	Toolpushers	Drillers	Drilling Crews	Others	Total	Fingers	Hands	Arms	Toes	Feet	Legs	Head	Eyes	Body	Total	Moving Machinery	Using Tools	Handling Tubing	Falling Objects	Other Causes	Total
Sprains, Contusions, Abrasions, Cuts and Lacerations	1	4	62	5	72	19	10	3	6	4	12	3	..	15	72	6	20	17	2	27	72
Fractures	..	1	14	1	16	3	2	1	..	6	2	..	..	2	16	1	5	3	1	6	16
Burns	..	..	2	..	2	1	..	..	..	..	..	..	1	..	2	1	..	..	..	1	2
Other Injuries	..	2	1	..	3	1	..	..	..	..	..	..	..	2	3	..	1	..	..	2	3
Totals	1	7	79	6	93	24	12	4	6	10	14	3	1	19	93	8	26	20	3	36	93

Lost time incurred—	Man days
Toolpushers	30
Drillers	249
Drilling Crews	1,044
Others	247
Total	1,570

4. Legislation

In view of the increasing interest in offshore areas a Bill to make provision with respect to the exploration and exploitation of the sea-bed and sub-soil of the submarine areas adjacent to the State of Queensland and its dependencies, was introduced and passed by Parliament in 1964. The Act may be cited as "*The Mineral Resources (Adjacent Submarine Areas) Act of* 1964".

In addition, a number of conferences between the Commonwealth and States were convened in order to clarify the position as to jurisdiction over these areas, with a view to the passing of complementary legislation governing offshore exploration and exploitation rights.

Although no other new legislation was enacted during the year, considerable progress was made towards finalisation of operating petroleum regulations, work on which was commenced in 1963. The uniform draft code previously submitted to the Commonwealth and to other States was discussed with a committee set up by industry, and by the end of the year a set of regulations had been arrived at which it is believed will be satisfactory to all parties concerned.

5. Pipelines

Moonie Pipeline Company Pty. Ltd. holds Pipeline License No. 1 the only such license in Australia, for the 191-mile, 10¾-in. o.d., oil pipeline from Moonie to Lytton terminus, at the mouth of Brisbane River.

During 1964, construction was completed and the pipeline brought into operation. Filling with crude oil commenced on 4th March and the oil arrived at Lytton terminal on 28th March. Normal operations commenced on 4th April, with Moonie pump station operating as required on day shift only. The first shipment from Lytton terminal was 147,718 barrels on 25th May.

During the year, Moonie pumping station received 1,482,969 barrels of crude and 1,237,924 barrels were lifted by tankers at Lytton terminal.

The pipeline operated normally with no interruptions. It was inspected from the air at weekly intervals and once by ground patrol. Scraper pigs were passed through the line at regular intervals but no appreciable quantity of wax was recovered.

As mentioned above (Section 1–1) preliminary moves were made by the Associated Group towards the construction of a gas pipeline from Roma to Brisbane. This followed the issue in December of an Order in Council authorising Mines Administration Pty. Ltd. to enter lands along the probable route, for survey purposes.

A 4-in. pipeline, approximately 7 miles in length, was constructed to supply natural gas from the Richmond field to a new power station in Roma. The new power station was also tied in to the existing 2 in. line from the well Timbury Hills No. 2 to the old power station.

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QUEENSLAND
DEPARTMENT OF DEVELOPMENT AND MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

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THE KHOLO SUB-GROUP OF THE IPSWICH COAL MEASURES

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PREFACE

This paper by Mr. R. J. Allen sets out the results of a detailed investigation of the stratigraphy and petrology of the hitherto little known Kholo Sub-Group of the Ipswich Coal Measures. This basal section of the Coal Measures contains no workable coal and no doubt its neglect in the past is attributable to this factor.

Nevertheless it is of more than ordinary geological interest and not without economic significance, particularly in relation to extractive industries.

The paper can be regarded as complementary to the various coal resources reports on the Ipswich Coalfield put out by this Department from time to time.

A. K. DENMEAD,
Chief Government Geologist.

September, 1960.

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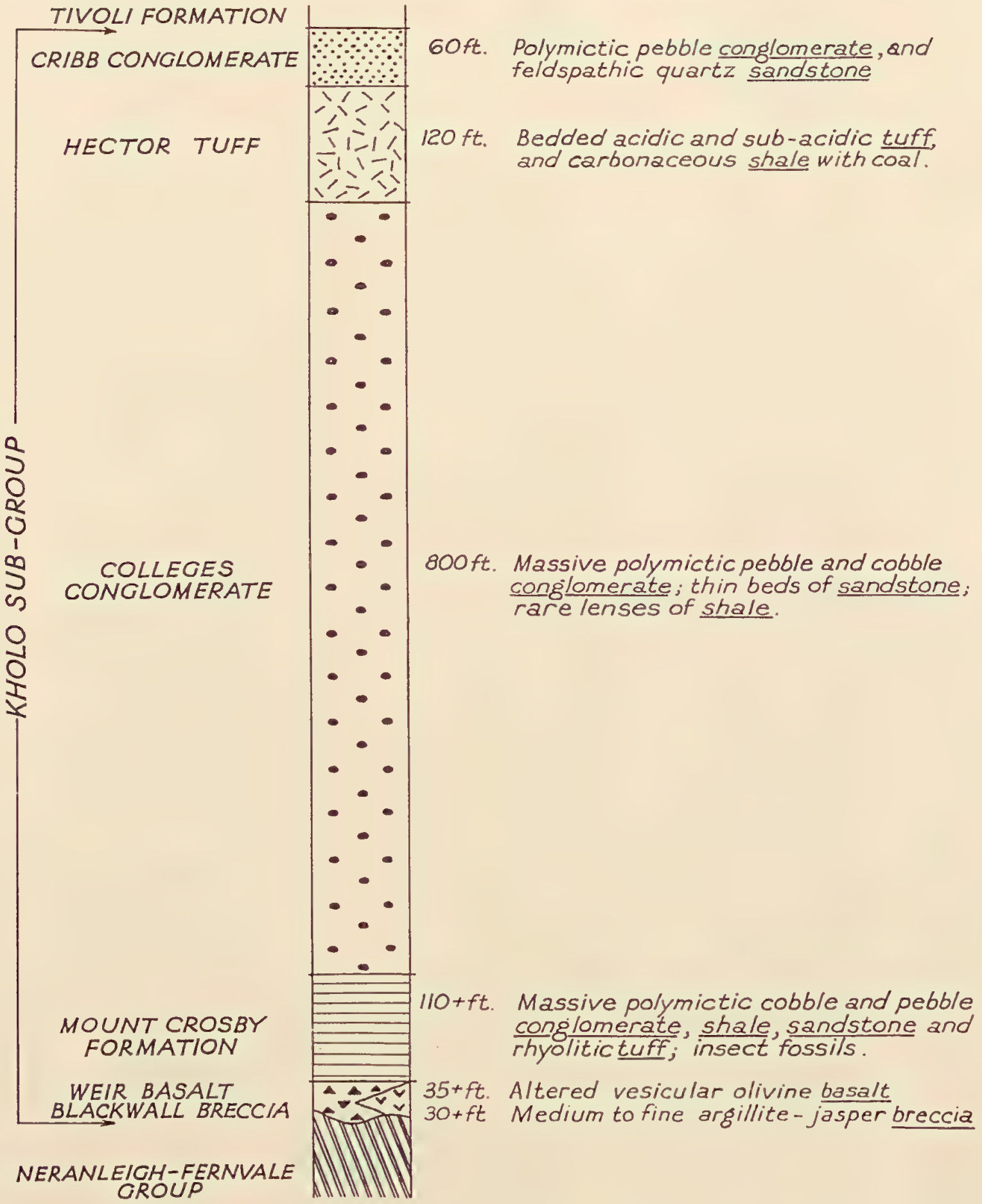
TIVOLI FORMATION
CRIBB CONGLOMERATE
60ft. Polymictic pebble conglomerate, and feldspathic quartz sandstone
HECTOR TUFF
120 ft. Bedded acidic and sub-acidic tuff, and carbonaceous shale with coal.
KHOLO SUB-GROUP
COLLEGES CONGLOMERATE
800ft. Massive polymictic pebble and cobble conglomerate; thin beds of sandstone; rare lenses of shale.
MOUNT CROSBY FORMATION
110+ft. Massive polymictic cobble and pebble conglomerate, shale, sandstone and rhyolitic tuff; insect fossils.
WEIR BASALT
35+ft. Altered vesicular olivine basalt
BLACKWALL BRECCIA
30+ft Medium to fine argillite-jasper breccia
NERANLEIGH-FERNVALE GROUP

FIGURE 1

STRATIGRAPHIC SECTION

KHOLO SUB-GROUP

SCALE OF FEET

0 100 200 300 400

THE KHOLO SUB-GROUP OF THE IPSWICH COAL MEASURES

ABSTRACT

The Kholo Sub-Group (Allen, 1959) comprises the following six formations:

Cribb Conglomerate	60 ft	
Hector Tuff	120 ft	
Colleges Conglomerate	800 ft	
Mount Crosby Formation	110+ft	
Blackwall Breccia	30 ft	Weir Basalt 35+ ft

at the base of the Ipswich Coal Measures (Bryan and Jones, 1950). This is a group of Middle Triassic continental sediments exposed about Ipswich, in the Moreton Basin, 19 miles west-south-west of Brisbane. The Kholo Sub-Group crops out along the northern margin of the basin, in the Kholo–Blackwall–Mount Crosby area, 5 miles north of Ipswich. It has been met in one deep bore in the Ipswich coalfield—Mines Department N.S. 93, Cooneana (Hawkins, 1956). It lies unconformably on the Lower Palaeozoic (?) Neranleigh–Fernvale Group and is overlain conformably by the Tivoli Formation of the Ipswich Coal Measures, and unconformably by Quaternary (?) alluvium.

The Blackwall Breccia is a basal sedimentary breccia composed of detritus from the local Neranleigh–Fernvale beds. The Weir Basalt is an altered olivine basalt, apparently lying very near the base of the Sub-Group. The Mount Crosby Formation consists of polymictic cobble to pebble conglomerate, illitic-montmorillonitic shale, argillaceous lithic-quartzose sandstone and rhyolitic tuff. The shale contains fossil insects and plants. The Colleges Conglomerate is a very thick polymictic pebble to cobble conglomerate, apparently deposited marginally as a fan at the foot of the D'Aguilar Block. The Hector Tuff consists of bedded acidic and sub-acidic tuff, and carbonaceous shale with thin beds of coal. The Cribb Conglomerate consists of polymictic pebble conglomerate and quartzose–feldspathic sandstone.

The boundary between the Kholo Sub-Group and the Neranleigh–Fernvale Group marks approximately the original shore line of the basin. The general dip of the Sub-Group is south–south–westward at about 10°. Folding and faulting are minor only.

TABLE 1.—Stratigraphic Table, Ipswich Coal Measures

Age	Group/Formation				
Upper Triassic ?	Bundamba Group				
	unconformity				
Middle Triassic	Ipswich Coal Measures 4300+ft.	Blackstone Formation	800 ft.		
		Cooneana Formation	800 ft.		
		Tivoli Formation	1,550 ft.		
		Cribb Conglomerate	60 ft.		Kholo Sub-Group 1100+ft.
		Hector Tuff	120 ft.		
		Colleges Conglomerate	800 ft.		
		Mount Crosby Formation	110+ft.		
		Blackwall Breccia	30+ft.	Weir Basalt 35+ft.	
	unconformity				
Lower Palaeozoic ?	Neranleigh–Fernvale Group				

INTRODUCTION

The Ipswich Coal Measures (Bryan and Jones, 1950) is a group of Middle Triassic continental sediments, which occur in the Ipswich area in the Moreton Basin, about 19 miles west–south–west of Brisbane. The Kholo Sub-Group (Allen, 1959) comprises the non-productive basal portion of the group (Table 1; Fig. 1). It crops out in the Kholo–Blackwall–Mount Crosby area, 5 miles north of Ipswich, and has been met in one deep bore in the Ipswich coalfield—Mines Department N.S. 93, Cooneana (Hawkins, 1956)—4 miles east–south–east of Ipswich. It lies unconformably on the Lower Palaeozoic (?) Neranleigh-Fernvale Group, and is overlain conformably by the Tivoli Formation and unconformably by Quaternary (?) alluvium.

Previous Work

Cameron (1899A, B) mapped the northern boundary of the Ipswich coalfield from Pullen Creek westward through Mount Crosby to Pine Mountain. Later (Cameron, 1907, 1923) he revised his interpretation of the area. Reid and Morton (1922A, B) studied the Ipswich basal beds in the North Ipswich area. In 1925, Jones and Denmead (Jones, 1927B) discovered the Mount Crosby insect beds, and Jones (1927A) indicated their stratigraphic horizon. Denmead (1928) in a survey of the "Brisbane Schists", described the massive radiolarian jaspers of the Mount Crosby area. Hill (1930) correlated the Ipswich "basal conglomerate" with the Bellevue Conglomerate and Esk Shales. Tillyard (1937) described two new species of *Triassoblatta* from the Mount Crosby insect beds. Tindale

(1945) described a probable lepidopterous insect from these beds. Jones and de Jersey (1947) collected fossil plants from the insect beds at four localities, and described several new forms. Dodds (1949) described six new species of *Triassoblatta* from the insect beds. Denmead (1955) mapped the Kholo–Mount Crosby area in a stratigraphic survey of the Ipswich coalfield. He divided the Ipswich Coal Measures into four "stages", in the lowest of which, the "Kholo Stage" he recognised five units:

White Conglomerate	60 ft.
Tuff Beds	120 ft.
Kholo Conglomerate	800 ft.
Mount Crosby Insect Shales	80 ft.
Basal Andesite	?

Present Survey

The present survey was carried out in 1953–54, as a research project towards the degree of B.Sc. with Honours in Geology and Mineralogy, in the University of Queensland. The area was re-examined in 1958-59 for the Geological Survey of Queensland; the thesis was completely revised for this publication.

The Kholo Sub-Group was examined in detail from Kholo eastward to Johnsons Rocks. Aerial photographs were used for location in the field. A base map was prepared from an uncontrolled mosaic, with the grid of the IPSWICH 1 mile military map (Second Edition, 1951) superimposed.

A new formation (Blackwall Breccia) was recognised. Denmead's (1955) units were re-named in conformity with the Australian Code of Stratigraphic Nomenclature.

The roundness of phenoclasts and grains was estimated with the aid of the visual chart in Krumbein and Sloss (1953, p. 81). The average size was estimated by eye. The composition of conglomerate was determined very approximately by counting a small sample of phenoclasts, and expressing the results as proportions of igneous, metamorphic and sedimentary rock. The composition of sandstone was determined approximately from a single thin section by traversing with a point counter, at least fifty times the average grain size; the composition was expressed as percentages of quartz, "quartzite" (all essentially siliceous composite grains, including vein quartz, quartzite, jasper, chert), labile rocks, feldspars, micas, and matrix or cement. The shales were studied by differential thermal analysis.

The specimens and thin sections are referred to by the numbers which they bear as part of the collection of the Department of Geology and Mineralogy, University of Queensland (e.g. rock specimen R15167; thin section 4628; fossil insect C2288).

Acknowledgements

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NERANLEIGH–FERNVALE GROUP

(Specimens R15000-9; thin sections 4500-8)

The oldest rocks exposed in the Kholo–Mount Crosby area are argillite, jasper, quartzite and basic tuff of the Neranleigh–Fernvale Group (defined by Bryan and Jones, 1950). They are thought to be of Lower Palaeozoic age. They strike west-north-westward, dip steeply, and are overlain unconformably by the lower formations of the Kholo Sub-Group.

BLACKWALL BRECCIA

(Specimens R15034-60; thin sections 4521-45)

The Blackwall Breccia (Allen, 1959) consists of 30+ ft. of sedimentary breccia, lying unconformably on the Neranleigh–Fernvale Group. It is a massive to poorly bedded, poorly sorted, medium to fine breccia, composed of angular (0·1) fragments of argillite, jasper, quartzite and rarely, fine basic volcanic rock, apparently derived locally from the Neranleigh–Fernvale Group. Where argillite phenoclasts predominate, the matrix is argillaceous and generally weak; where jasper phenoclasts predominate, the matrix has a ferruginous or siliceous cement, which is generally strong. The type locality is in the gully at 913817 near The Blackwall. The formation has been mapped from The Blackwall eastward to 958806, south-east of Mount Crosby. Similar breccia crops out further up the Brisbane Valley (Hill, 1930) and at the base of the Ipswich Coal Measures at Windsor, in Brisbane (Fisher, 1931).

Petrology

At the type locality at 913817 Blackwall, the Blackwall Breccia consists of about 30 ft of argillite breccia (Plate 1c) lying unconformably on Neranleigh–Fernvale beds. The phenoclasts are mainly of weathered argillite, but include some fresh argillite and jasper. Maximum size is 50 mm, except in the higher horizons, where some phenoclasts of jasper have a maximum size of 150 mm. The matrix is argillaceous.

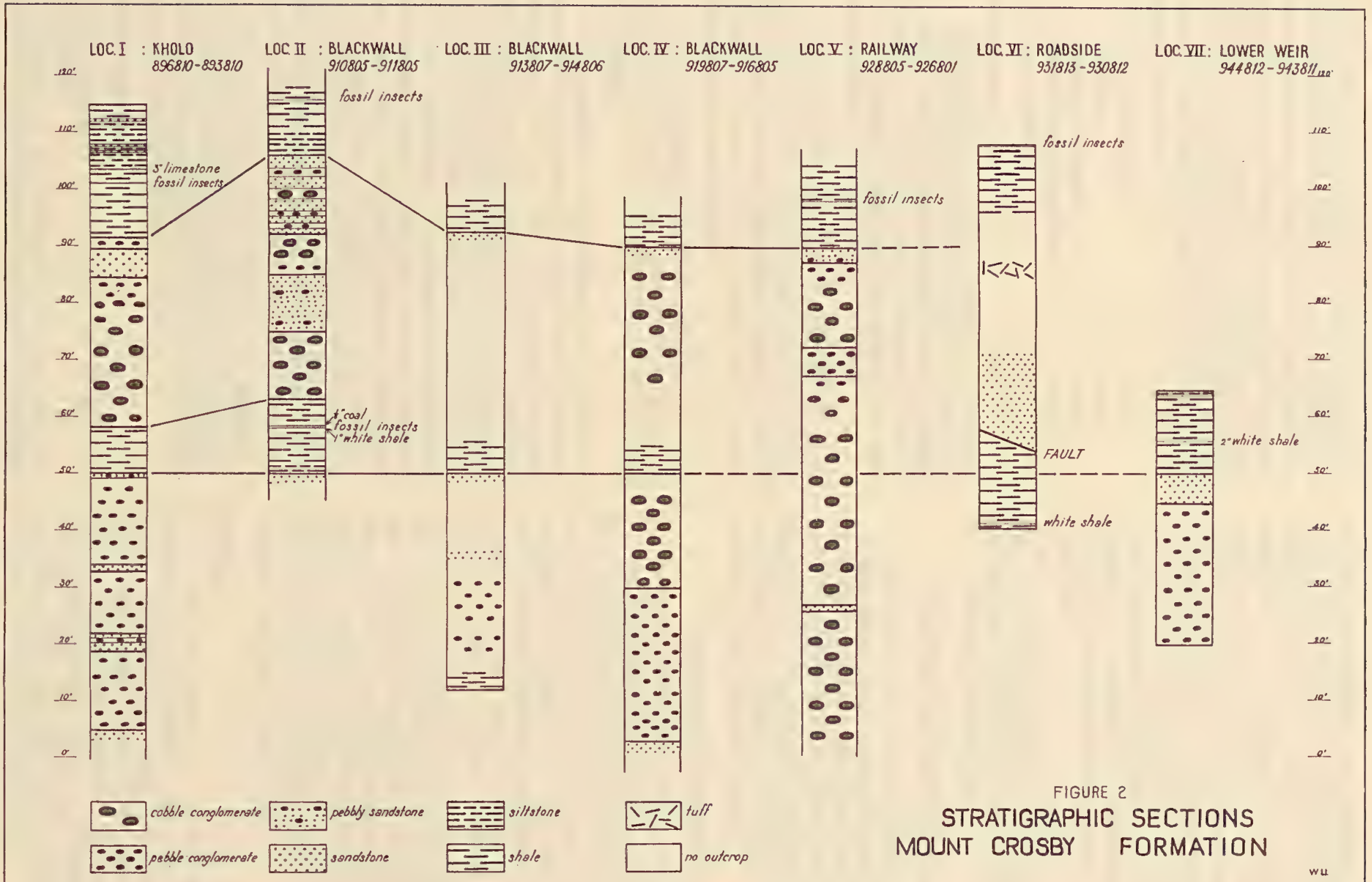


FIGURE 2

STRATIGRAPHIC SECTIONS
MOUNT CROSBY FORMATION

WU

In the creek bend at Blackwall 912805, jasper breccia (R15034/4521) dips eastward at 60°. The phenoclasts are of jasper, of roundness 0·1; maximum size is 15 mm and average size about 5 mm. Sorting is poor. The matrix consists of smaller grains of jasper, cemented by fine-grained ferruginous material. The bed is 5+ ft thick. Lying against the Neranleigh–Fernvale jasper at this locality, is a breccia (R15035/4522) composed of angular fragments of red jasper in a greenish-brown fine-grained matrix: Because of its west-north-westerly strike, vertical dip and close proximity to the older rocks, this may be a fault breccia.

Granule conglomerate (R15166/4627) underlies the Mount Crosby Formation at Locality III: 913807–914806, Blackwall; roundness ranges from 0·1 to 0·3; maximum size is 10 mm and average size about 2 mm; sorting is poor; the phenoclasts are of argillite and quartzite in about equal proportions; the matrix is argillaceous. A similar pebble conglomerate (R15186/4640), 3 in. thick, underlies the Mount Crosby Formation in the railway cutting at 928805 (Locality V); the roundness is about 0·5; the phenoclasts are of argillite and jasper (radiolarian); the matrix is argillaceous. These conglomerates are lithologically the same as the typical breccia, and differ from it only in greater roundness of phenoclasts.

In the breccia on the ridge at 916809, two-thirds of the phenoclasts are of jasper (some radiolarian) and one-third of argillite. The roundness ranges from 0·1 to 0·3; the maximum size of phenoclasts is 25 mm; sorting is poor.

Argillite breccia (R15051/4539) crops out at the gully junction 913812. It is composed of angular fragments of argillite, of maximum size 25 mm, in a strong olive-green argillaceous matrix, containing grains of argillite and jasper, and casts of radiolaria.

Jasper breccia crops at 922807 (Plate 1d); the bed is 6+ ft thick. The phenoclasts are mostly of brown jasper, but include argillite; they range in size from 2·0 mm to 50 mm. The matrix contains grains of jasper and argillite, and a few casts of radiolaria. Near the base, the cement is crystalline silica (R15055/4542), and higher up it is limonite (R15056/4545; Plate 3e).

Breccia (R15057/4544), similar in appearance, crops out west of the road at 926810. The phenoclasts are of jasper and argillite, of maximum size 25 mm. The jasper fragments are mostly angular and the argillite fragments are slightly rounded. The cement is ferruginous.

Breccia, possibly part of the Blackwall Breccia, crops out below the Mount Crosby Formation on the roadside at 932814. The phenoclasts are of quartzite, of roundness up to 0·3, and maximum size 280 mm. They are coated with a thin film of dark-red ferruginous material, which has also penetrated cracks in them. The matrix is argillaceous.

At 944812 north of the lower weir, breccia lies unconformably on the Neranleigh–Fernvale Group, and appears to contain a flow (?) of the Weir Basalt. The phenoclasts are up to 650 mm in size. Their roundness ranges from 0·1 to 0·3, increasing towards the top of the bed; this suggests that the upper material was derived from a source more distant that that of the lower. The phenoclasts are of quartzite, fine basic volcanic rock, and argillite; the matrix is argillaceous. The bed is about 20 ft thick.

On the roadside at 952809, argillite breccia (R15060) lies unconformably on Neranleigh–Fernvale strata. The roundness ranges from 0·1 to 0·3; average size is about 10 mm; sorting is poor. The phenoclasts are mostly weathered argillite, but include a little quartzite. The matrix is argillaceous; towards the top of the bed it increases in amount relative to the phenoclasts, the breccia thus grading up into mudstone. The total thickness of the formation here is 10+ ft.

Argillite breccia (R15059) with a fairly strong matrix, crops out on the roadside at 958806. The maximum size of phenoclasts is 10 mm.

Sedimentary Environment

Hill (1930) described from the Wivenhoe area in the Brisbane Valley ". . . about 50 feet of a breccia in which the fragments were chiefly quartzites which possibly represented a shore-line breccia . . ." This breccia lay above trachyte and an andesite which Hill correlated with the basal andesite at Sahls Pocket and Mount Crosby (Weir Basalt), and below the Bellevue Conglomerate, which Hill correlated with the "basal Ipswich conglomerate" (Colleges Conglomerate).

Fisher (1931) described a breccia, similar in character to the Blackwall Breccia, from the base of the Ipswich Coal Measures at Windsor Railway Station, near Brisbane. He regarded it as a scree deposit on the side of a steep embankment of schist.

The slight rounding of some phenoclasts, the slight sorting, the poor bedding, and the fact that in some localities the phenoclasts differ in composition from the underlying rock, indicate that the Blackwall Breccia is neither a fossil soil nor generally a scree deposit. It appears to be a sediment formed at the margin of the basin, of debris derived locally from the Neranleigh–Fernvale beds.

WEIR BASALT

(Specimens R15010-26; thin sections 4509-18)

The Weir Basalt (Allen, 1959) consists of 35+ ft of altered olivine basalt, lying unconformably on the Neanleigh–Fernvale Group in the Mount Crosby area. It was first mapped and described by Cameron (1899A, B), and was named the Basal Andesite by Denmead (1955). The Weir Basalt crops out at 947822 in Weir Gully (the type locality), at 944812 north of the lower weir (Plate 1a), on the roadside at 933816, and along the river at 933820 and 933821 (Plate 1b). It appears to be confined to this small area. Similar volcanic rock crops out in Sahls Pocket, 6 miles west–north–west of Mount Crosby (Hill, 1930) and at Moggill, 4 miles east of Mount Crosby (Sugars Basalt) (Allen, 1959).

Petrology

The Weir Basalt is a greenish-grey to black holocrystalline microphyric volcanic rock, the groundmass of which consists of crystals of plagioclase feldspar, chlorite, opaque minerals and rarely, pyroxene. The feldspar crystals are lath-like, 0·2 mm to 0·4 mm long, and are either randomly oriented (thin section 4511) or sub-parallel (thin sections 4510, 4514); their composition is about that of labradorite. The chlorite occurs as aggregates. The opaque minerals include magnetite and haematite. Thin section 4511 contains small crystals of fresh pyroxene of average size 0·04 mm.

The phenocrysts are laths of feldspar of maximum size 1·3 mm (thin section 4512), pseudomorphs of maximum size 2·0 mm of serpentine and opaque minerals completely replacing olivine (thin section 4509), and small red blebs of haematite, numerous in R15014.

A typical specimen of Weir Basalt from 945822 Mount Crosby, is shown in thin section (4515) in Plate 3f.

The basalt is commonly vesicular. Thin section 4512 contains small irregularly shaped vesicles of maximum size 3 mm; most are lined with carbonate, and filled with iron-stained chalcedony; others are filled completely with carbonate. R15010 contains regular elongate vesicles, of maximum size 10 mm. In R15019 the larger vesicles are filled with pink zeolite; in R15022 the vesicles are filled with greenish-white zeolite.

Some parts of the basalt are altered; the rock is coloured greenish-grey, and contains a larger amount of chlorite, and carbonate.

R15012 (thin section 4510) from 932819 contains xenoliths of quartzite, possibly derived from the Neranleigh–Fernvale Group. The basalt at 945822 contains a xenolith of rhyolite (R15020), several feet in diameter.

Spheroidally weathered basalt is exposed in a tunnel at 947822 in Weir Gully. The spheroids are 6 in. to 8in. in diameter.

The maximum thickness of the Weir Basalt is unknown. In the bank overlooking the river at 938821, the vertical thickness is 35+ ft.

Age

Cameron (1899A, B; 1923) and Jones (1927A) considered that the Weir Basalt was of Tertiary age. Hill (1930) and Denmead (1955) considered that it lay at the base of the Ipswich Coal Measures.

On the river at 936821, the basalt appears to lie unconformably on the Neranleigh–Fernvale Group; in the tunnel at 947822, the basalt is faulted against the Neranleigh–Fernvale Group; at 944812 north of the lower weir, a flow (?) of basalt appears to be interbedded with the Blackwall Breccia. The basalt appears not to be intrusive. However, no phenoclasts of the basalt have been found in the sediments of the Kholo Sub-Group.

Although incomplete, the evidence suggests that the Weir Basalt lies very near the base of the Kholo Sub-Group and is of about the same age as the Blackwall Breccia.

MOUNT CROSBY FORMATION

(Specimens R15062-197; thin sections 4546-645)

The Mount Crosby Formation (Allen, 1959) consists of 110+ ft of conglomerate, shale, sandstone and rhyolitic tuff, lying conformably on the Blackwall Breccia. It has been mapped from about 890815 Kholo, eastward to about 952809. The type locality may be taken as the roadside 931813–930812, Mount Crosby (Locality VI, refer below); however, because of lithologic variation laterally, no section is completely representative of the formation.

The formation was first described by Jones (1927A), who with Denmead, had discovered fossil insects in the shale at the type locality (Jones, 1927B). Tillyard (1937), Tindale (1945) and Dodds (1949) described fossil insects from the formation, and Jones and de Jersey (1947) described the flora. Denmead (1955) mapped the formation, and named it the Mount Crosby Insect Shales.

Petrology

Conglomerate forms the bulk of the formation. It is massive, poorly sorted, polymictic conglomerate, composed of well-rounded (0·7) cobbles and pebbles of sedimentary, igneous and metamorphic rocks.

The shale is coloured olive-green, dark-grey and yellowish-brown. It is composed of quartz and a mixed-layer mineral consisting of randomly interstratified layers of illite and montmorillonite in the proportion 85:15. Three shale members lie near the bottom, middle and top, respectively, of the formation; they are up to 20 ft thick. The middle shale member contains a 2 in. marker bed of white shale, and several very thin seams of bright coal. Both the middle and upper shale members contain fossil insects.

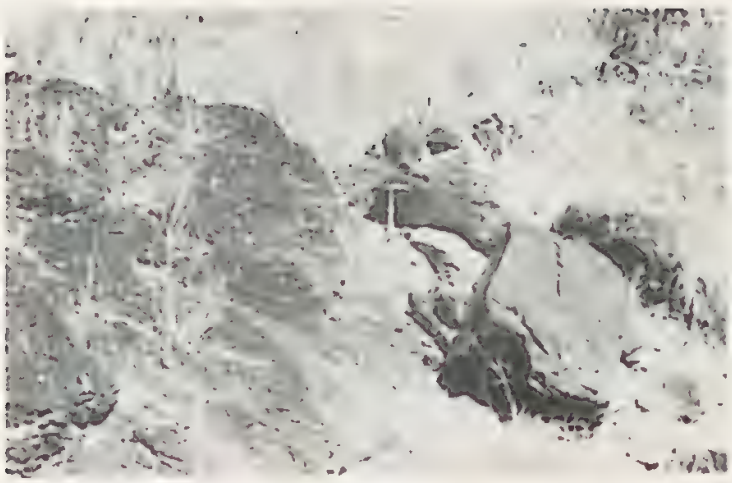
The sandstone occurs in beds generally less than 5 ft thick, within the conglomerate members, and underlying the middle and upper shale members. The grains are generally angular to sub-rounded (0·1 to 0·3); average size is generally about 0·5 mm; composition is generally about: quartz 20%, "quartzite" 10+%, labile rocks (argillite, fine volcanic rocks, etc.) 15%, feldspars 10+%, micas 10—%, argillaceous (chloritic) matrix 30%.

The rhyolitic tuff crops out only in the embayment about the type locality, in a single bed up to 5 ft thick, lying between the middle and upper shale members.

Stratigraphic sections (Fig. 2) were measured at the following seven localities along the strike, from Kholo eastward to the lower weir:

I:	Kholo . .	896810–893810
II:	Blackwall . .	910805–911805
III:	Blackwall . .	913807–914806
IV:	Blackwall . .	919807–916805
V:	Railway . .	928805–926801
VI:	Roadside . .	931813–930812
VII:	Lower weir . .	944812–943811

PLATE 1

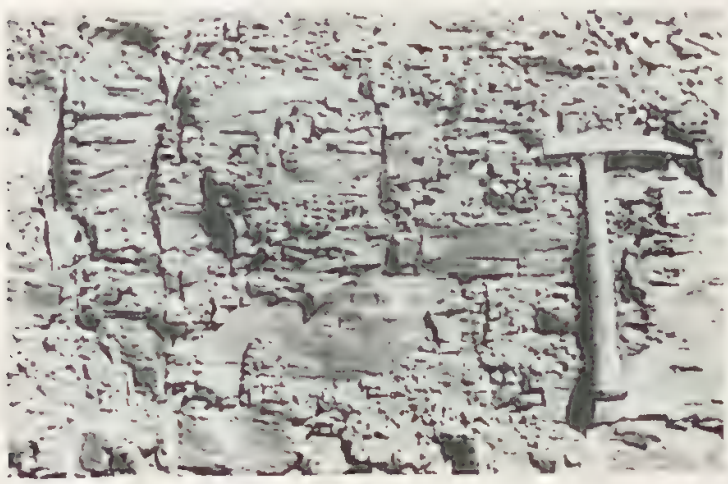


a.

b.

c.

d.



e.

f.

a. Argillite of Neranleigh–Fernvale Group, and boulders of basalt of Weir Basalt, 944812 Mount Crosby.

b. Basalt of Weir Basalt at 938821 Mount Crosby.

c. Argillite breccia of Blackwall Breccia at type locality, 913817 Blackwall.

d. Jasper breccia of Blackwall Breccia at 922807.

e. Shale of Mount Crosby Formation at lower weir, 943811 (Locality VII).

f. Cobble conglomerate of Mount Crosby Formation at 910805 Blackwall (Locality II).

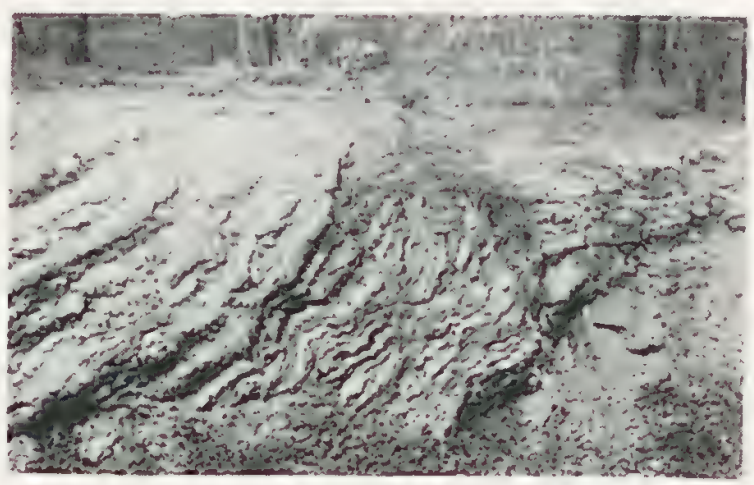
a.

b.

c.

d.

e.



f.

a. Cliff of Colleges Conglomerate at 942810, south of lower weir.

b. Pebble conglomerate of Colleges Conglomerate on roadside at 940794, near Colleges Crossing.

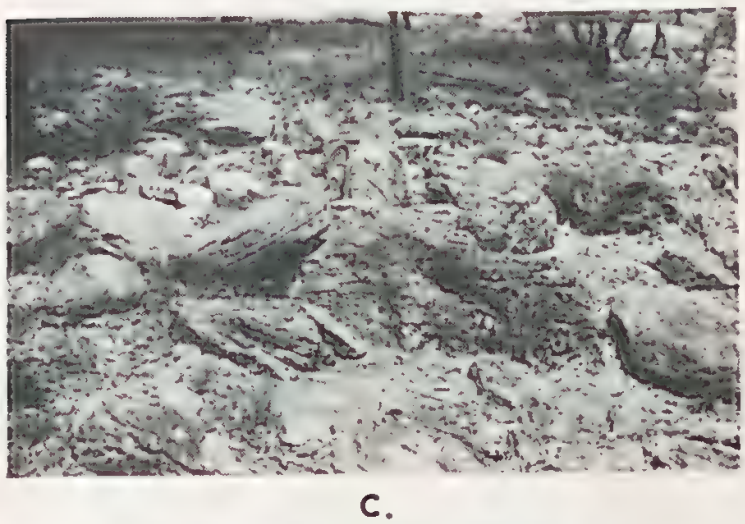
c. Pebbly sandstone of Colleges Conglomerate on roadside at 942794, near Colleges Crossing.

d. Carbonaceous shale and coal of Hector Tuff in railway cutting at 919792. Dip southward at 15°.

e-f. Faulted carbonaceous shale, coal and tuff of Hector Tuff, in eastern side of railway cutting at 919792.

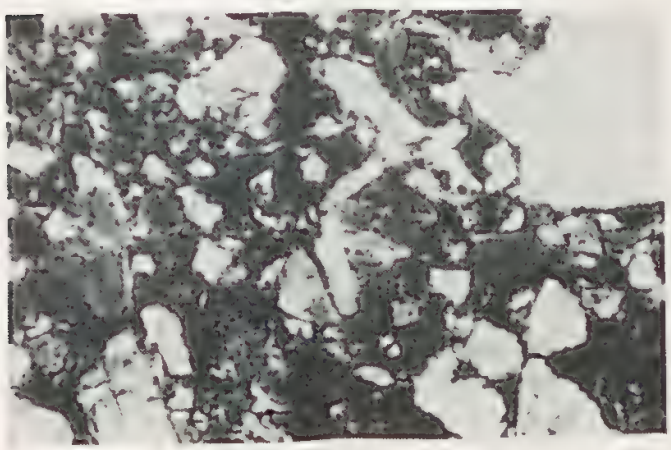
a.

b.



c.

d.



e.

f.

a. Faulted syncline in tuff of Hector Tuff, in railway cutting at 910788.

b. Tuff of Hector Tuff, exposed in railway cutting at 911787. Dip southward at 10°.

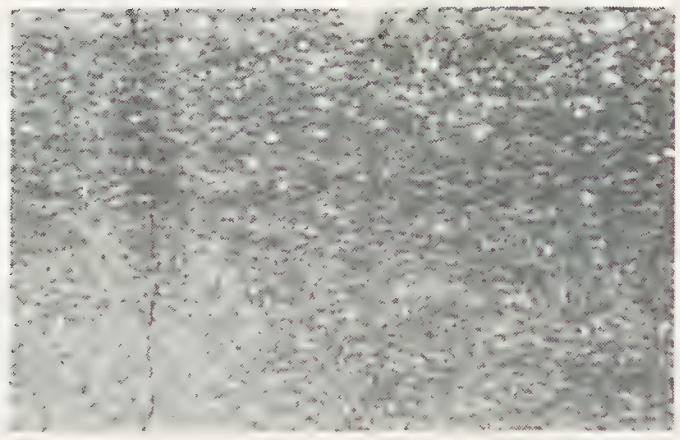
c. Sandstone and pebble conglomerate of Cribb Conglomerate at 900788, near type locality.

d. Sandstone of Cribb Conglomerate at Kholo Bridge, 889787. Dip south-eastward at 10°.

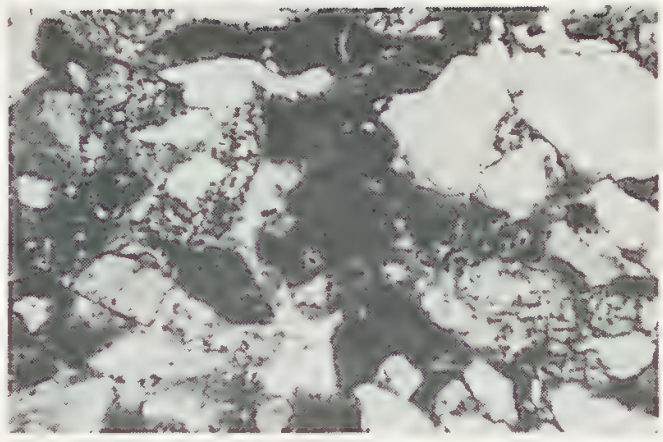
e. Matrix of breccia from Blackwall Breccia at 922807, showing angular grains of jasper and argillite cemented by limonite. 4543. Ordinary light. x26.

f. Basalt from Weir Basalt at 945822, showing a vesicle containing chlorite within calcite, in a groundmass of plagioclase feldspar, chlorite, and opaque minerals. 4515. Ordinary light. x26.

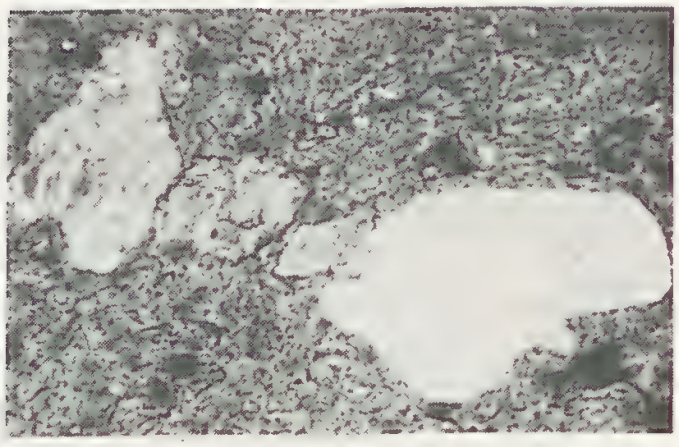
PLATE 4.



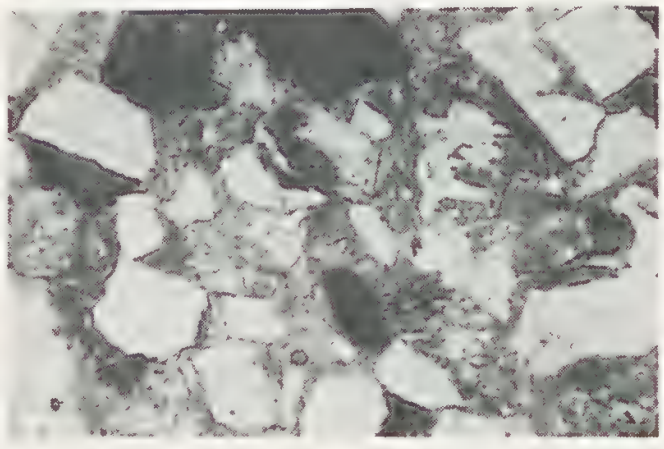
a.



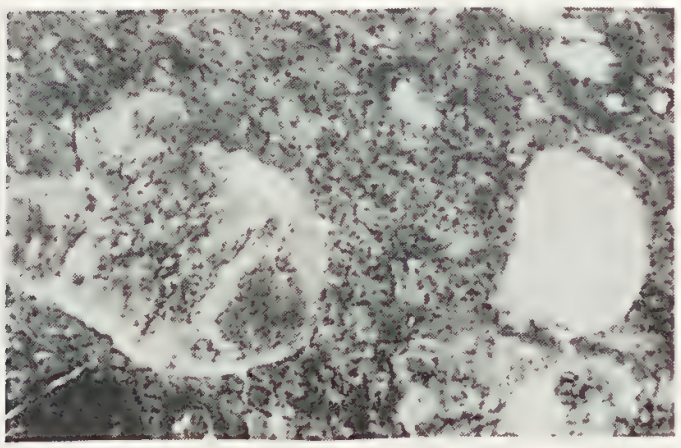
b.



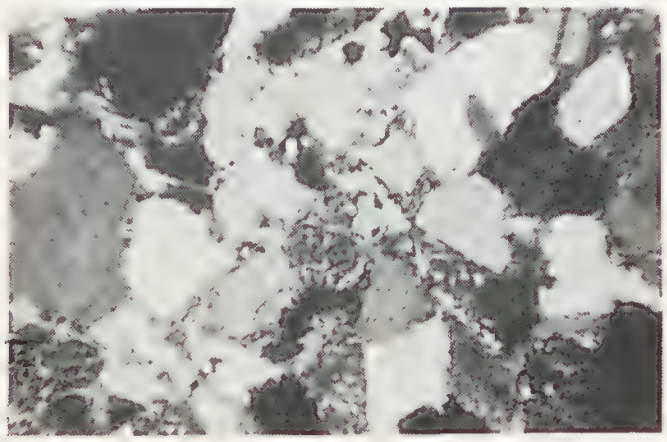
c.



d.



e.



f.

a. Dark-grey shale from Mount Crosby Formation at 894810, showing abundant silt-sized grains of quartz. 4564. Ordinary light. x26.

b. Sandstone from Mount Crosby Formation at 895810, showing grains of quartz, rock, feldspars and micas, in an argillaceous matrix. 4562. Ordinary light. x26.

c. Rhyolitic tuff from Mount Crosby Formation at 931814, showing subhedral grains of quartz and feldspar, in a fine matrix containing much chlorite. 4638. Ordinary light. x26.

d. Sandstone from Colleges Conglomerate at 949794, showing grains of quartz, rock, feldspars and micas, cemented by carbonate. 4669. Ordinary light. x26.

e. Acid tuff from Hector Tuff at 910788, showing grains of quartz, altered feldspar, and rock, in a fine matrix. 4674. Ordinary light. x26.

f. Sandstone from Cribb Conglomerate at 889787, showing grains of quartz, rock, feldspars and micas, cemented by finely crystalline silica. 4684. Crossed nicols. x26.

Locality I: Kholo, 896810–893810.

This locality is on the western flank of the Kholo Anticline. It is Insect Locality E of Tindale (1945) and Floral Locality 3 of Jones and de Jersey (1947). The section is:

— Colleges Conglomerate (sandstone and pebbly sandstone, overlain by pebble conglomerate).

23 ft Shale. Towards the base the member is fine dark-grey shale; in thin section (4564) (Plate 4a), laminae 2 mm thick, of coarser material, alternate with laminae 1 mm thick of finer material; angular detrital quartz is common, as 0·0025 mm grains in the coarser material, and 0·001 mm in the finer, respectively; the dark argillaceous matrix contains much fine chlorite. About 10 ft above the base of the member is an horizon of fossil insects. About 2 ft above the insect horizon, a 3 in. bed of cone-in-cone limestone (R15074/4558) overlies calcareous shale (R15075/4559); the limestone shows films of clay between the concentric cones. At 16 ft and 20 ft above the base of the member, are beds of sandstone, each about 6 in. thick.

2 ft Pebble conglomerate.

5 ft Sandstone (R15079/4562) (Plate 4b); roundness is up to 0·5; maximum size is 2·1 mm, average size about 0·8 mm; composition is approximately: quartz 23%, "quartzite" 17%, labile rocks 18%, feldspars 11%, micas (mainly biotite) 2%, argillaceous (chloritic) matrix 29%.

26 ft Cobble conglomerate; poorly sorted; bedding is indicated by several small lenses of sandstone, a few inches thick; roundness of phenoclasts is 0·7 to 0·9; maximum size is 250 mm; three-fifths of the phenoclasts are of sedimentary rock (greywacke, arkose, feldspathic sandstone, pebble conglomerate), and two-fifths of igneous rock (quartz feldspar porphyry, granite, rhyolite); the matrix is composed of sand grains, cemented by carbonate.

8+ ft Shale (R15103/4583); thin laminae of dark fine material alternate with thicker laminae of coarser material; contains many small angular grains of quartz, feldspar and mica.

1 ft Sandstone, pebbly (R15104/4584); the roundness of sand grains is about 0·1 to 0·3; maximum size is 3·3 mm, average size is about 0·7 mm; composition is approximately: quartz 25%, "quartzite" 25%, labile rocks 15%, feldspars 15%, micas 1%, argillaceous (chloritic) matrix 20%.

40 ft Pebble conglomerate, with a few beds up to 1 ft 6 in. thick, of sandstone (R15108/4587) similar in composition to the underlying sandstone (R15109/4588).

2+ ft Sandstone (R15109/4588); roundness of grains is about 0·1 to 0·3; maximum size is 1·9 mm, average size is about 0·4 mm; composition is approximately: quartz 25%, "quartzite" 8%, labile rocks 15%, feldspars 10%, micas 8%, calcareous cement 35%.

Locality II: Blackwall, 910805–911805.

This is Insect Locality C of Tindale (1945) and Floral Locality 2 of Jones and de Jersey (1947). The strata crop out in a steep gully running westward from the road at 911805. The section is:

— Colleges Conglomerate (base not exposed).

7+ ft Shale, olive-green, weathering yellowish-brown. An insect horizon occurs 4 ft above base.

5 ft Shale, silty, and thin-bedded sandstone, light-yellow, very weathered.

2 ft Sandstone (R15152/4615); the roundness of the grains is about 0·1 to 0·3; maximum size is 0·7 mm, average size is about 0·3 mm; the composition is approximately: quartz 20%, "quartzite" 10%, labile rocks 25%, feldspars (partly replaced by carbonate) 15%, micas 4%, cement 25%, partly argillaceous and partly siliceous, with carbonate filling voids.

1 ft 6 in. Pebble conglomerate, with a few cobbles.

2 ft Sandstone, with a few small pebbles of maximum size 5 mm.

2 ft Pebble conglomerate, grading up into cobble conglomerate. This contained a cobble (R15150/4613) composed of conglomerate.

2 ft Sandstone, thin-bedded, with a thin lens of pebbly sandstone about 1 ft above base.

1 ft Pebble conglomerate.

1 ft Sandstone, pebbly.

1 ft Pebble conglomerate.

1 ft Sandstone (R15151/4614).

7 ft Pebble conglomerate (3 ft) grading up into cobble conglomerate (4 ft) (Plate 1f); the largest phenoclast was a boulder of yellowish-brown quartzite, 300 mm long, with sphericity of 0·5 and roundness of 0·7.

10 ft Sandstone, with many thin bands, generally one pebble thick, of pebbles, with a few cobbles.

12 ft Cobble conglomerate, resting disconformably on the underlying shale; roundness of phenoclasts is up to 0·7; maximum size is 270 mm, average size is about 80 mm; sorting is poor; two-thirds of the phenoclasts are of sedimentary and metamorphic rock (greywacke, sandstone, argillite), and one-third of igneous rock (granite, quartz feldspar porphyry). The argillite is not the same as that in the Blackwall Breccia. One cobble of granite (R15126/4596) has matrix of an older conglomerate adhering to it, and must therefore be at least second cycle.

13 ft Shale, dark-grey to black, silty at base. About 8 ft above the base is a 1 in. bed of greyish-white shale (R15121), in part stained light-yellowish-brown; it is poorly bedded, and partly broken down to clay.

(A similar bed of white shale occurs within dark shale at 901808 Kholo and at Locality VII: Lower weir, 943810. It is a useful marker).

The dark shale for a few inches above and below the white shale bears plant and insect fragments (refer Palaeontology). About 3 in. above the white shale is a seam of bright coal, $\frac{1}{8}$ in. thick. A proximate analysis was made by Mr. H. Allen:

moisture	12%
volatiles	25%
fixed carbon	38%
ash	25%

1+ ft Sandstone (R15120/4595); the roundness of grains is about 0·1 to 0·3; maximum size is 0·9 mm, average size is about 0·2 mm; composition is approximately: quartz 20%, "quartzite" 20%, labile rocks 4%, feldspars 8%, micas 20%, argillaceous (chloritic) matrix 30%.

LOCALITY III: Blackwall, 913807–914806.

— Colleges Conglomerate (base not exposed).

5+ ft Shale.

1+ ft Sandstone (R15167).

38— ft No outcrop.

3+ ft Shale.

1+ ft Sandstone (R15168).

22— ft No outcrop.

2+ ft Sandstone.

2— ft No outcrop.

13+ ft Pebble conglomerate.

4— ft No outcrop.

3+ ft Silty shale (R15169), yellowish-brown, with impressions of a species of *Czekanowskia* reported by Jones and de Jersey (1947, p. 61). Blackwall Breccia (granule conglomerate at top).

LOCALITY IV: Blackwall, 919807–916805.

— Colleges Conglomerate (base not exposed).

2+ ft Shale.

1+ ft Sandstone.

20+ ft Cobble conglomerate.

12— ft No outcrop.

5+ ft Shale.

3— ft No outcrop.

45+ ft Pebble conglomerate (30 ft) grading up into cobble conglomerate (15 ft).

1+ ft Sandstone.

LOCALITY V: Railway, 928805–926801.

The formation is well exposed in the cuttings along the old Mount Crosby railway, from 928805 to 926801. Insect Locality B of Tindale (1945) is at 926802 at the western end of the cutting crossed by the Mount Crosby road. The formation rests conformably on the Blackwall Breccia. The section is:

— Colleges Conglomerate (base not exposed).

14+ ft Shale, olive-brown (R15189) near the base, dark-grey (R15190) higher up. About 8 ft above the base is an horizon of fossil insects.

3 ft Sandstone (R15188/4642), with pebbles, especially near the base; roundness of grains is about 0·1 to 0·3; maximum size is 1·3 mm, average size is about 0·7 mm; composition is approximately: quartz 28%, "quartzite" 8%, labile rocks 27%; feldspar 6%, micas (mainly biotite) 5%, argillaceous (chloritic) matrix 26%.

15 ft Cobble conglomerate.

5 ft Pebble conglomerate.

40 ft Cobble conglomerate.

1 ft 3 in. Sandstone (R15187/4641).

22 ft Cobble conglomerate; at the base, the roundness of phenoclasts is 0·7; maximum size is 150 mm and average size about 100 mm; sorting is poor; the phenoclasts are of feldspathic sandstone, silicified sandstone, silicified argillite, jasper, quartzite and feldspar porphyry.

25— ft No outcrop.

— Blackwall Breccia.

LOCALITY VI: Roadside, 931813–930812.

This is the type locality of the Mount Crosby Formation. It is Insect Locality A (Tindale, 1945), at which Jones and Denmead discovered fossil insects in the formation (Jones, 1927A, B). It is also Floral Localities 1 and 4 of Jones and de Jersey (1947). The section is:

—	Colleges Conglomerate.
12+ ft	Shale (R15185), olive-brown; there is a fossil insect horizon at the top of the shale, which is overlain disconformably by the conglomerate.
9— ft	No outcrop.
2+ ft	Rhyolitic tuff (R15182/4638) (Plate 4c), greenish-brown; the largest fragments are of quartz (euhedral and subhedral, some embayed, of maximum size 0·7 mm), feldspar (subhedral, much altered), and a little sanidine and oligoclase; the matrix is fine-grained and contains much chlorite, and a few small shards of glass; carbonaceous matter occurs also.
13— ft	No outcrop.
12+ ft	Sandstone (R15184/4639); roundness of grains is about 0·1 to 0·3; maximum size is 0·6 mm, average size is about 0·1 mm; composition is approximately: quartz 20%, "quartzite" 7%, labile rocks 13%, feldspars 15%, micas 10%, argillaceous (chloritic) matrix 35%.
3+ ft	Siltstone (R15181/4637); roundness of grains is up to 0·5; maximum size is 0·7 mm, average size is about 0·05 mm; grains of quartz, biotite and feldspar "float" in a calcareous matrix; streaks of carbonaceous material represent plant fragments.
—	Fault, throw unknown.
15 ft	Shale (R15183), dark-grey. About 8 in. above the base is a sequence of four thin beds of white shale (R15180), ½ in. to 2 in. thick, separated by thin beds of dark-grey shale.
—	Blackwall Breccia?

LOCALITY VII: Lower Weir, 944812–943811.

This is Insect Locality D (Tindale, 1945). The section here is:

—	Colleges Conglomerate.
6 in.	Siltstone (R15193/4644); roundness of grains is about 0·1 to 0·3; maximum size is 0·4 mm, average size is about 0·03 mm; the grains are of quartz, biotite and feldspar, and the matrix is argillaceous (chloritic).
15 ft	Shale (R15195), dark-grey to black near the base, brown and silty towards the top. The member is well-exposed at the lower weir, 943811 (Plate 1e). It contains an 8 in. seam of bright coal (Denmead, 1955). About 6 ft above the base of the member there is a bed of white shale, (R15194), 1 in. to 2 in. thick, similar to the bed of white shale in the lower shale member at Locality II.
5 ft	Sandstone (R15196/4645), friable; roundness of grains is about 0·1 to 0·3; maximum size is 0·9 mm, average size is about 0·2 mm; composition is approximately: quartz 12%, "quartzite" 5%, labile rocks 10%, feldspars 17%, micas 11%, argillaceous (chloritic) matrix 45%.
25 ft	Pebble conglomerate; roundness is about 0·7; maximum size is 150 mm, average size is about 50 mm; about four-fifths of the phenoclasts are of sedimentary and low-grade metamorphic rocks (feldspathic sandstone, greywacke, chert, silicified sandstone, micaceous sandstone, pebble conglomerate, argillite, jasper, quartzite, phyllite, vein quartz) and one-fifth of igneous rock (quartz feldspar porphyry, quartz porphyry, rhyolite).

MISCELLANEOUS OUTCROPS

Dark shale, carbonaceous shale with thin bands of coal, and sandstone, crop out in an outlier at about 897823 Kholo.

Brown very fine-grained micaceous quartz sandstone with argillaceous (chloritic) matrix (R15062/4546), crops out on the western side of the road at 892816 Kholo. It was not seen in the section at Locality I: Kholo, 896810–893810, although similar sandstone crops out at 898817 Kholo (R15064/4548) and at 915809 Blackwall (R15173).

Representatives of the Mount Crosby Formation crop out in the outlier north-east of The Blackwall. Shale was found at 909816 and 913813, and conglomerate at 913813.

In the gully at 929816, there is an exposure of some 10 ft of shale, white (R15179) to grey, and light-yellowish-brown (R15178), containing fragments of *Stenopteris* sp., *Johnstonia* sp. and *?Yabeiella* sp. In appearance and in mineral composition (refer below), this shale is unlike the typical shale of the Mount Crosby Formation, and may be slightly older.

In the outlier at 952819 Mount Crosby, greenish-grey and white indurated mudstone, 6+ ft thick, overlies argillite breccia of the Blackwall Breccia. Some of the white mudstone at the base of the bed contains small rounded fragments of green clay, the

largest being of granule size. The bed is overlain by fawn to brown and grey shale containing carbonised plant fragments.

Brown micaceous silty mudstone overlies Blackwall Breccia in the gully west of the road at 946811 Mount Crosby.

Greyish-white siltstone, brownish-grey mudstone and sandstone overlie the Blackwall Breccia on the roadside at 952809 Mount Crosby.

Mineral Composition of the Shales

Two specimens of shale—R15080 of dark shale from the upper bed at Locality I, and R15117 of white shale from a 2 in. band of white shale in dark shale at 901808 Kholo—were submitted to the Division of Building Research, C.S.I.R.O., for differential thermal analysis by Dr. J. A. Ferguson, and X-ray analysis by Dr. W. F. Cole.

Dr. Ferguson reported (personal communication to Dr. D. Hill, 28-8-53) that R15080 was non-typical of Ipswich shale, being high in mixed-layer mineral or montmorillonite. Only one Ipswich shale (from Dinmore pottery) of those which he had examined previously was like it; all others were largely kaolinitic. R15117 was also very rich in well-hydrated minerals, and contained some mineral rich in iron.

Dr. Cole reported as follows (personal communication, 26-10-53): "(R15080) contains a good deal of quartz, and a mixed-layer type mineral, consisting of random interstratification of layers of illite and montmorillonite in the proportion 85:15. In addition, there is a smaller amount of a 14A clay mineral, non-expanding upon glycerol treatment, which is not definitely identified. It is not chlorite, but could be vermiculite, or if such a thing exists, a non-expanding montmorillonite. The constituent is not in sufficient quantity to be certain and any further work would involve removing organic matter and fractionating at various particle sizes. (R15117) differs from (R15080) in having less quartz and more clay, being essentially a mixed-layer mineral formed by the random interstratification of layers of illite and montmorillonite in the proportion 65:35. Of interest also is the occurrence of X-ray lines which are interpreted as an ordered stacking of illite and montmorillonite in equal proportion. The sample is similar in this respect to one that I have recently described from Tasmania (Cole and Carthew, 1953). It cannot be said that the interpretation of the diffraction effects is necessarily correct in either your own or the Surges Bay sample as there must be some common factor which relates the occurrence of random and ordered stacking effects of the same type of layers. You can be certain, however, that mixed-layer intergrowths exist formed by the loss of potassium from between the mica layers and its replacement by water layers forming within any one crystal a certain number of expanded-layers alternating with unexpanded ones."

This work was used as a basis for further study of the shales by differential thermal analysis, using an apparatus designed and built in the Department of Geology and Mineralogy, University of Queensland. The curves produced by this apparatus for the standard specimens R15080 and R15117, were very similar to the curves produced by the C.S.I.R.O. apparatus for the same specimens (Figure 3). Figure 4 illustrates the curves produced for the fourteen specimens, including the two standard specimens, of shale from the Mount Crosby Formation.

The following eight specimens of the dark shale were analysed:

R15103 from lower shale at Locality I (Fig. 4b).
R15154 from upper shale at Locality II (Fig. 4c).
R15124 from lower shale at Locality II (Fig. 4d).
R15169 from lowest shale at Locality III (Fig. 4e).
R15190 from shale at Locality V (Fig. 4f).
R15185 from upper shale at Locality VI (Fig. 4g).
R15183 from lower shale at Locality VI (Fig. 4h).
R15195 from shale at Locality VII (Fig. 4i).

All except the last gave curves similar to that of the standard dark shale, R15080 (Figure 4a) from the upper shale at Locality I, and thus were considered to have essentially the same mineral composition. The last, R15195, from the shale at Locality VII, gave a curve (Figure 4i) generally similar to that of the standard dark shale, R15080, but with certain characteristics of its own, notably the marked exothermic peak at about 600°.

The following three specimens of white shale were analysed:

R15121 from 1 in. band in lower (dark) shale at Locality II (Fig. 4k).

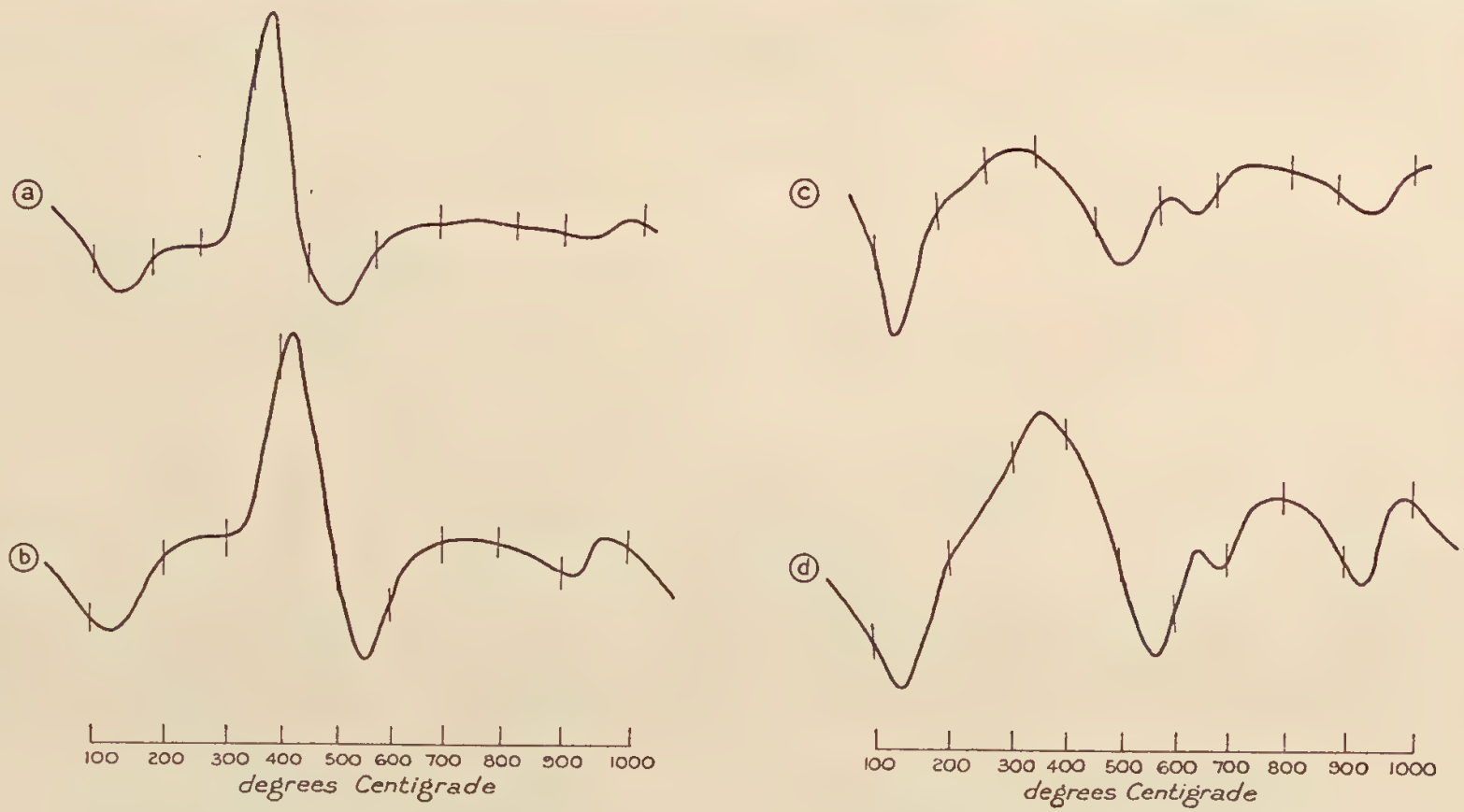
R15194 from 1–2 in. band in (dark) shale at Locality VII (Fig. 4l).

R15180 from thin beds of white shale near base of lower (dark) shale at Locality VI (Fig. 4m).

The first two specimens, R15121 and R15194, gave curves very similar to that given by the standard, R15117 (Figure 4j-l), and therefore were considered to have essentially the same mineral composition. The third white shale, R15180, gave a curve (Figure 4m) different to that of the standard white shale, but similar to the curve (Figure 4n) given by specimen R15170, of shale from 929816 Mount Crosby.

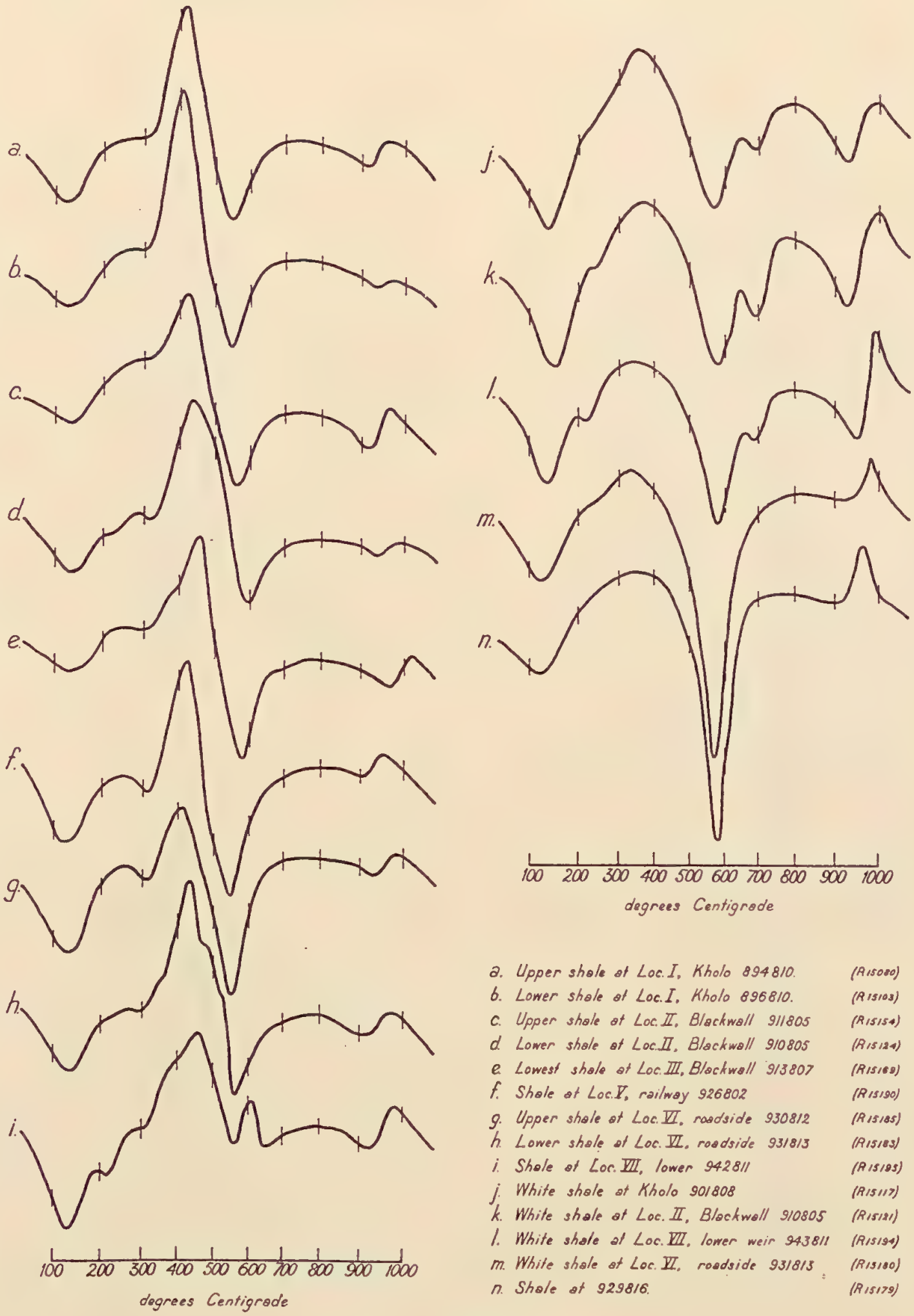
FIGURE 3

COMPARISON OF D.T.A. CURVES PRODUCED AT C.S.I.R.O. AND AT U.Q. DEPT. OF GEOLOGY



a. *Curve given by R.15080 on C.S.I.R.O. apparatus.*
b. *Curve given by R.15080 on U.Q. Dept. of Geology apparatus*

c. *Curve given by R.15117 on C.S.I.R.O. apparatus.*
d. *Curve given by R.15117 on U.Q. Dept. of Geology apparatus.*



a. Upper shale at Loc. I, Kholo 894810. (R15080)
b. Lower shale at Loc. I, Kholo 896810. (R15103)
c. Upper shale at Loc. II, Blackwall 911805 (R15154)
d. Lower shale at Loc. II, Blackwall 910805 (R15124)
e. Lowest shale at Loc. III, Blackwall 913807 (R15169)
f. Shale at Loc. V, railway 926802 (R15190)
g. Upper shale at Loc. VI, roadside 930812 (R15185)
h. Lower shale at Loc. VI, roadside 931813 (R15183)
i. Shale at Loc. VII, lower 942811 (R15193)
j. White shale at Kholo 901808 (R15117)
k. White shale at Loc. II, Blackwall 910805 (R15121)
l. White shale at Loc. VII, lower weir 943811 (R15194)
m. White shale at Loc. VI, roadside 931813 (R15180)
n. Shale at 929816. (R15179)

FIGURE 4

D.T.A. CURVES OF SHALES OF MOUNT CROSBY FORMATION

TABLE 2.—Insect, Floral and Stratigraphic Section Localities—Mount Crosby Formation
Refer Queensland 20 chain maps 2523–2524 and Ipswich 1 mile military map

Insect Localities (Tindale, 1945)	Floral Localities (Jones & de Jersey, 1947)	Stratigraphic Section Localities (present survey)
A. Roadside between Por. 172 and Por. 92, Par. Chuwar (930812). (Location given incorrectly as Por. 205, Par. Chuwar, by Tillyard, 1937).	4. Roadside, Por. 92, Par. Chuwar (930812); shale immediately below Colleges Conglomerate, about 60 ft above Loc. 1; same horizon as Loc. 3. 1. Roadside, Por. 92, Par. Chuwar (931813)	VI. Roadside, 931813–930812
B. Railway cutting, Por. 202, Par. Chuwar (926803).	——	V. Railway, 928805–926801
C. Gully, Por. 171, Par. Chuwar (About 910805).	2. Por. 171, Par. Chuwar; (about 910805); same horizon as Loc. 1.	II. Blackwall, 910805–911805
D. Lower weir, Mount Crosby (943811). (Location given incorrectly as Por. 22–23, Par. Kholo, by Tindale, 1945).	——	VII. Lower weir, 944812–943811
E. Por. 10–11, Par. Kholo (About 894810–894812).	3. Por. 10, Par. Kholo (About 893810)	I. Kholo, 896810–893810

Palaeontology

Fauna

Fossil insects have been found in the shales of the Mount Crosby Formation at five localities (Table 2). O. A. Jones and A. K. Denmead (Jones, 1927A, B) made the first discovery, at 930812 Mount Crosby (Insect Locality A of Tindale, 1945, and Locality VI of the present survey). H. Cribb traced the shales laterally, and found fossil insects at four other localities (B-E of Tindale, 1945).

The fossil insects have been studied by Tillyard (1937), Tindale (1945) and Dodds (1949). Tindale noted that: "several thousand specimens have been secured by different collectors from the several occurrences . . . Impressions of wings of Coleoptera and Orthoptera seem to predominate, but wings of many Homoptera as well as some Mecoptera, Trichoptera and kindred insects occur." One possible lepidopterous insect—*Eoses triassica* gen. et sp. nov. (Tindale, 1945)—and the following eight species of the cockroach genus *Triassoblatta* (Tillyard, 1919) have been described:

Triassoblatta dehiscens n. sp. . . Dodds (1949).
T. denmeadi n. sp. . . . . Tillyard (1937).
T. grandis n. sp. . . . . Dodds (1949).
T. intramedia n. sp. . . . . Dodds (1949).
T. jonesi n. sp. . . . . Tillyard (1937).
T. obtusa n. sp. . . . . Dodds (1949).
T. ovata n. sp. . . . . Dodds (1949).
T. triquestra n. sp. . . . . Dodds (1949).

During the present survey, fossil insects were collected from the horizon a few inches above and below the white shale bed in the lower shale member at Locality II: Blackwall, 910805–911805. (Insect Locality C). E. F. Riek (personal communication, 24-12-53) identified the specimens as:

Hemiptera: C2288 (*Mesocixiodes* cf *termioneura*, Tillyard, 1923, from Denmark Hill).
Mecoptera: C2274 A and B.
Cockroach: C2285, C2296, C2297.
Beetle elytra: C2284, C2294, C2295, C2297, C2306A and B.
Body fragments: C2279, C2300, C2301, C2304, F17275A and B.

Flora

The flora of the Mount Crosby Formation has been described by Jones (1927A), who collected from Insect Locality A, and by Jones and de Jersey (1947) who collected from four localities (Table 2). It includes:

Neocalamites sp.
Schizoneura sp.
Cladophlebis australis
Cladophlebis johnstoni
Dicroidium odontopteroides
Stenopteris elongata
Doratophyllum tenison-woodsi
Ginkgoites magnifolius
Ginkgoites antarctica
Czekanowskia tenuifolia
Czekanowskia sp.
Yabeiella brackebuschiana
Yabeiella mareyesiaca
Fraxinopsis major
Leptostrobus sp.
gymnosperm seeds

The flora is probably Middle Triassic in age (Jones and de Jersey, 1947).

Only a few plant fossils were collected during the present survey. Impressions of a species of *Czekanowskia* reported by Jones and de Jersey (1947, p. 61) as distinct from *Czekanowskia tenuifolia,* were found in silty shale (R15169) at the base of the section at Locality III: Blackwall, 913807–914806. Fragments of *Stenopteris* sp., *Johnstonia* sp. and ?*Yabeiella* sp. were found in shale at 929816 Mount Crosby.

Sedimentary Environment

Shales

Regarding the origin of the shales, Dr. W. F. Cole (personal communication, 17-12-53) stated: "The mixed-layer minerals in general represent steps in a weathering sequence which for a normal cycle would proceed from illite to montmorillonite. The weathering may well have been pre-depositional, and not represent a present weathering cycle. (The dark shale R15080) in containing more illite component would be less weathered than (the white shale R15117) in which the montmorillonite component is higher due to water replacing potash in the mica layers. The fact that the different samples occupy distinct beds would tend to indicate that the shales could well have the same composition now as when they were deposited."

The chief clay-like mineral of the Bunya Phyllite (which underlies the Neranleigh–Fernvale Group) is a mica-type mineral composed of mica-like (80-70%) and montmorillonitic 20-30%) clay minerals, interlayered more or less regularly, and held together in a non-expanding lattice; this mineral was carried over into soil and sedimentary derivatives (Ferguson, 1951).

The presence of carbonate in the Mount Crosby Formation indicates an alkaline environment of deposition. Such an environment appears to favour accumulation of montmorillonite and illite (Millott, 1949; Grim, 1953).

The Mount Crosby Formation may belong to Type B of Whitehouse's (1952) two facies in the Mesozoic freshwater sediments of Queensland. In this facies the sandstones and clays are calcareous, "the clays being, probably, in origin, montmorillonitic." Deposition took place under "ponded conditions with swamps" during periods of relatively steady rainfall.

Conglomerates and Sandstones

The conglomerates are relatively mature in texture, but immature in composition. The sandstones are immature in both texture and composition. The detritus appears to have been eroded rapidly from a provenance of high relief, transported a short distance and deposited in an alluvial fan. The several cycles of gradual transition upwards from conglomerate through sandstone to shale, followed by abrupt return to conglomerate, may indicate gradual lowering of the provenance by erosion, followed by uplift due to renewed tectonic activity.

Tuff

The thin rhyolitic tuff in the embayment about the type locality records a brief period of explosive volcanic activity.

COLLEGES CONGLOMERATE

(Specimens R15198-230; thin sections 4646-70)

The Colleges Conglomerate (Allen, 1959) consists of about 800 ft of massive polymictic pebble to cobble conglomerate, thin beds of sandstone and a few small lenses of shale. It has been mapped and described by Cameron (1899A, B; 1907), who named it the Basal Conglomerate, by Reid and Morton (1922A, B), by Hill (1930) and by Denmead (1954; 1955), who named it the Kholo Conglomerate. The Colleges Conglomerate lies conformably on the Mount Crosby Formation at some localities (e.g. 893810) and disconformably at others (e.g. 930812). It also lies disconformably on the Blackwall Breccia (e.g. at 926810) and unconformably on the Neranleigh–Fernvale Group (e.g. at 969798). The type locality is at Colleges Crossing, 949794, where the formation crops out in high cliffs along the southern bank of the Brisbane River. North-westward the Colleges Conglomerate grades laterally into the Bellevue Conglomerate of the Esk Basin (Hill, 1930). Eastward it extends to Pullen Vale, thinning progressively (Denmead, 1955). Hawkins (1956) correlated fine conglomerate in the interval 1,748 ft to 1,784 ft in N.S. 93, Cooneana, with the Colleges Conglomerate. If this correlation is correct, the Colleges Conglomerate becomes finer, and wedges out from about 800 ft in thickness at outcrop to only about 35 ft in this bore, about 5 miles down dip.

Petrology

At the type locality, 949794, the formation consists mainly of conglomerate, with thin beds of sandstone. The conglomerate is a coarse pebble conglomerate with a few cobbles and boulders of maximum size 270 mm; average size of phenoclasts is about 60 mm; roundness is about 0·5 to 0·7; the phenoclasts are of rhyolitic agglomerate, quartz feldspar porphyry, greywacke and other sediments, jasper, quartzite, chert and vein quartz. Sandstone (R15228/4669) from this locality is brown in colour; average roundness of grains is about 0·3; maximum size is 1·4 mm, average size is about 0·5 mm; composition is approximately: quartz 23%, "quartzite" 4%, labile rocks 15%, feldspars 12%, micas 4%, calcareous cement 42%. Sandstone (R15229/4670) from 933798 is grey in colour; average roundness of grains is about 0·5; maximum size is 2·0 mm, average size is about 0·7 mm; composition is approximately: quartz 35%, "quartzite" 3%, labile rocks 30%, feldspars 13%, micas 1%, siliceous cement 18%.

Plate 2b shows typical conglomerate at 940794, and Plate 2c shows pebbly sandstone within the conglomerate, at 942794.

A pebble of indurated sandstone containing bryozoa, was collected by Dr. D. Hill from pebbles weathered out of the Colleges Conglomerate at 929812. Dr. J. Beattie (personal communication, 3-8-54) identified the majority of the bryozoa as *Fenestella osbornei,* and the others as *F. cincta, F. malchi, Polypora palenensis, Fenestella* spp., *Polypora* sp., and

Pennirétepora sp.; she concluded that they were more like Neerkol than Permian forms. This is the only palaeontological evidence of the age of the sedimentary rocks which contributed to the Colleges Conglomerate.

The formation is well-exposed along the old railway from 926800 to 919793. Here it consists mainly of pebble conglomerate, fairly fine at the base, coarser towards the middle, and fine again near the top. The average roundness of phenoclasts is about 0·7, and the maximum size is 150 mm. At 923797 nearly half of the phenoclasts examined were of sedimentary rock (feldspathic sandstone, greywacke, argillite, siltstone, pebble conglomerate), and the rest were of igneous (rhyolite, aplite, granite, quartz feldspar porphyry, andesite) and metamorphic rock (jasper, quartzite, meta-greywacke, meta-argillite), and of vein quartz. Sandstone (R15219/4663) from near the base of the formation at 926800, has an average roundness of grains of about 0·3; maximum size is 1·0 mm, average size is about 0·6 mm; composition is approximately: quartz 31%, "quartzite" 8%, labile rocks 16%, feldspars 9%, micas 4%, calcareous cement 32%. Sandstone (R15217/4661) from 921795, has roundness of grains of about 0·1 to 0·3; maximum size is 1·2 mm, average size is about 0·6 mm; composition is: quartz 30%, "quartzite" 3%, labile rocks 14%, feldspars 12%, micas 1%, calcareous cement 40%.

At 893810 Kholo, the Colleges Conglomerate lies conformably upon the Mount Crosby Formation. The lowest beds are of sandstone and pebbly sandstone, similar to those in the Mount Crosby Formation. The higher beds are coarser; at about 20 ft above the base, pebble conglomerate predominates.

At 892808 and southward along the ridge running down the middle of Kholo Pocket, numerous cobbles and some boulders of jasper and quartzite lie scattered on the surface. The largest found was a boulder of light-brown jasper, of sphericity 0·5, roundness 0·5 and length 500 mm, at 892808. These phenoclasts are not typical of the phenoclasts weathered from the Colleges Conglomerate, which is essentially a pebble to cobble polymictic conglomerate, containing relatively few phenoclasts of jasper and quartzite. A. K. Denmead (personal communication) has suggested that these large siliceous phenoclasts at Kholo, and a similar accumulation around 945808 south of Mount Crosby, may have been deposited more recently than the Colleges Conglomerate, possibly as a high-level gravel.

Sedimentary Environment

Hill (1930) considered that the "conglomerate may represent a composite fan from more than one river flowing into the Ipswich basin . . . from the D'Aguilar block; or it may be the simple fan of one very large river . . ."

Denmead (1954) described the conglomerate as "a composite alluvial fan in an upland, but not a piedmont, environment, deposited during a sustained period of uniform subsidence during which climatic conditions remained remarkably constant, with no indication of even seasonal changes". He considered that the thickness of the deposit suggested a piedmont origin, but that the conglomerate, in its high degree of rounding and well-sorted condition, was not a typical fanglomerate.

The conglomerate is immature in composition, like those of the Mount Crosby Formation, but generally it is better sorted and finer in grade. It too appears to be the product of rapid erosion of a provenance of high relief. The great thickness and relative uniformity of the conglomerate suggest that the provenance rose more or less continuously as it was eroded.

The persistence of the conglomerate laterally along the margin of the basin, and its apparent wedging out and fining down dip, are characteristic of a fan or compound fan (Pettijohn, 1957).

The apparent wedge shape and orientation of the formation suggest that the provenance lay to the north, on the present D'Aguilar Block.

HECTOR TUFF

(Specimens R15231-57; thin sections 4671-83)

The Hector Tuff (Allen, 1959) consists of about 120 ft of bedded acidic and sub-acidic tuff, and carbonaceous shale with thin beds of coal, lying conformably on the Colleges Conglomerate. The formation has been mapped by Reid and Morton (1922A, B), and by Denmead (1955), who named it the Tuff Beds. The Hector Tuff crops out from about 875776, about 1 mile south-south-west of Kholo Bridge (Reid and Morton, 1922A), to about 970784 (Denmead, 1955), and was met from 1,481 ft to 1,748 ft in N.S. 93, Cooneana (Hawkins, 1956). The type section is exposed in the cuttings from 920794 to 911787 along the old Mount Crosby railway, which crosses Hector Gully at 912791. In this section the formation is about 120 ft thick. It thins eastward, being only 40 ft thick at the road corner 963783.

Petrology

The lower part of the type section, exposed in the cutting at 919792 (Plate 2d), consists of:

— Acid tuff, light-grey, showing in hand specimen (R15253) fragments of green mineral (talc?) of maximum size 20 mm, and other fragments of white clay after feldspar (?) of maximum size 3 mm, in a fine grained matrix; in thin section (4680) shows small crystals of feldspar, partly decomposed, and quartz, in a fine tuffaceous matrix which contains shards of devitrified glass.

25 ft Shale, carbonaceous, with thin beds of coal, more numerous (up to 50% coal) higher in the section. A proximate analysis of the coal was made by Mr. H. Allen:

moisture	13%
volatiles	27%
fixed carbon	41%
ash	19%

2 ft	Siliceous beds, with interbedded fine dark-grey tuff.
40 ft	Tuff, bedded.
2 ft	Tuff, light-brown, thin-bedded.
6 in.	Tuff, dark-grey, fine.

In this cutting at 919792, the upper part of the formation has been disturbed by faulting (Reid and Morton, 1922B; Denmead, 1955) (Plate 2e–f) and is better exposed in the cutting from 911789 to 910787 (Plate 3a–b). Here the section consists of carbonaceous shale and coal, poorly exposed, followed by 60 ft of bedded acidic tuff, coarsely bedded near base, and finely bedded near top.

R15241/4673, from 910788, is of light-grey rhyolitic tuff. It is composed of subhedral to anhedral grains, up to 1·5 mm in size, of quartz, feldspar (potash and plagioclase), rock fragments, mica and some iron ore, in a fine indeterminate matrix which contains a few shards of devitrified glass. A similar acid tuff (R15242/4674) from the same outcrop, is shown in thin section in Plate 4e.

Above the rhyolitic tuff (R15241) is a mottled greenish-brown tuff (R15243) containing mudballs ranging from 5 mm to 15 mm in diameter.

Overlying these beds, at 910788 is a light-grey bedded rhyolitic tuff with small anhedra of quartz and feldspar, about 0·05 mm in size; it is overlain by light and dark-grey laminated tuff, very fine-grained and well-indurated (R15246/4677-8).

Sedimentary Environment

The striking change in lithology from the Colleges Conglomerate to the Hector Tuff reflects an important change in tectonic conditions. The supply of gravel and sand to the basin was cut off, possibly through the provenance ceasing to rise. Volcanic activity began; lacustrine conditions prevailed, and carbonaceous shale and coal were deposited when volcanic activity ceased temporarily.

Denmead (1954) considered the change due to a renewal of tectonic activity in the line of the Brisbane Valley disturbance.

CRIBB CONGLOMERATE

(Specimens R15258-66; thin sections 4684-8)

The Cribb Conglomerate (Allen, 1959) consists of up to 60 ft of white to brown polymictic pebble conglomerate and feldspathic quartz sandstone, lying conformably on the Hector Tuff. It is the highest formation of the Kholo Sub-Group, and is overlain conformably by the Waterworks Seam of the Tivoli Formation (Denmead, 1955). The Cribb Conglomerate has been mapped by Reid and Morton (1922A, B), and by Denmead (1955), who named it the White Conglomerate. The type locality is at the head of Cribb Gully, about 898787. The formation crops out from 875776 about 1 mile south-south-west of Kholo Bridge (Reid and Morton, 1922A) to about 970784 (Denmead, 1955). Hawkins (1956) correlated white fine sandstone met from 1,460 ft to 1,480 ft in borehole N.S. 93, Cooneana, with the Cribb Conglomerate.

Petrology

Massive, strongly cemented white sandstone (R15258/4684) crops out at Kholo Bridge, 889787 (Plate 3d). In thin section (Plate 4f), the roundness of grains is about 0·1 to 0·3; maximum size is 1·6 mm, average size is about 0·8 mm; composition is approximately: quartz 33%, "quartzite" 3%, labile rock 5%, feldspar 31%, micas 1%, siliceous cement 27%.

On the track at 894787, white sandstone (R15261/4685) is overlain by 2 ft of shale, carbonaceous at the top. The shale is overlain by polymictic pebble conglomerate. Its phenoclasts are of average roundness about 0·7, maximum size 150 mm and average size about 60 mm; more than two-thirds are of igneous rock (aplite, quartz feldspar porphyry, feldspar porphyry, rhyolite) and less than one-third of metamorphic rock (jasper, quartzite).

Pebble conglomerate (R15263) crops out at the type locality, 897787. The average roundness of phenoclasts is about 0·7, and average size is about 30 mm. Similar conglomerate crops out near the road at 900788 (Plate 3d).

White sandstone (R15265/4687) crops out in the railway cutting at 910787. The average roundness of grains is about 0·1 to 0·3; maximum size is 1·0 mm, average size is about 0·6 mm; composition is approximately: quartz 20%, "quartzite" 6%, labile rocks 16%, feldspars 23%, micas 5%, siliceous cement 30%.

White sandstone, 11 ft thick, crops out in Sandy Creek at 913787.

Light-brown pebble conglomerate and brown sandstone, about 45 ft thick, crop out at 917785 in Sandy Creek. The phenoclasts of the conglomerate are of average roundness 0·7, maximum size 100 mm and average size about 40 mm, and are composed of jasper, quartzite, quartz and quartz porphyry.

White sandstone (R15266/4688) crops out on the roadside at 926790. The roundness of grains is about 0·1 to 0·3, maximum size is 1.8 mm, average size is about 0·7 mm; composition is approximately: quartz 32%, "quartzite" 8%, labile rocks 23%, feldspars 12%, micas 1%, siliceous cement 24%. This sandstone is overlain by pebble conglomerate. Its phenoclasts are of average roundness about 0·7 and maximum size 40 mm; they are composed of jasper, quartzite, quartz, rhyolite, and feldspathic sandstone.

On the roadside at 939789, the formation consists mainly of light-brown sandstone. White sandstone with a few small pebbles, less than 10 mm in diameter, crops out at 944787. Pebble conglomerate and sandstone crop out near the road at 963783.

Sedimentary Environment

The conglomerate is relatively mature in texture, but is immature in composition. It is finer in grade than, and different in composition from, the conglomerates of the Mount Crosby Formation and Colleges Conglomerate. Hence the provenance was probably different, and may have been further away.

The sandstone is immature in both texture and composition. The abundance of feldspar may indicate derivation by rapid mechanical erosion from a provenance including rocks rich in feldspar.

ALLUVIUM

Along the Brisbane River in the Kholo–Mount Crosby area, the Neranleigh–Fernvale and Kholo beds are overlain unconformably by alluvium, which is probably of Quaternary age.

The oldest alluvial deposits are high-level gravels, which occur generally at about the 100 ft contour on the IPSWICH 1 mile military map. They may be seen at 886795 Kholo, 908819 Blackwall, and 935818 and 938821 Mount Crosby. The deposit at 908819 Blackwall is silicified in part. The deposit at 935818 Mount Crosby is a cobble to pebble gravel; the phenoclasts are of jasper and rhyolite. The deposit of large siliceous phenoclasts at 892808 Kholo and 945808 Mount Crosby (refer Colleges Conglomerate) may be high-level gravels (A. K. Denmead, personal communication).

Sandy loam, probably younger than the high-level gravels, lies topographically below them, and closer to the river. Sandy loam may be seen in road cuttings at Kholo Bridge 889786, and Colleges Crossing 951797, and in the railway cutting 935815; at this locality the sandy loam is at a slightly higher level than in the road cuttings, and is podsolised. The sandy loam is generally terraced (refer accompanying geological map).

The most recent alluvial deposits are wide spreads of pebble to cobble gravel and some sand, lying in and along the river, especially in the inside of the river bends, as at 885785 Kholo, 903823 Blackwall, 942811 and 931802 Mount Crosby, and 945796 Colleges Crossing. These deposits lie below the sandy loam topographically.

STRUCTURE

Dip

The general dip of the Kholo Sub-Group is about 10° to the south–south–west.

Northern Boundary of the Basin

Cameron (1899A, B) considered that the northern boundary of the Ipswich basin was a fault junction. Later (Cameron, 1907) revised his opinion, stating that the boundary represented the original shore line of the basin.

Hill (1930) agreed with Cameron's later interpretation, and discussed the possibility that the angular cliffs of the Neranleigh–Fernvale beds might represent a fault scarp, preserved by the Mesozoic sedimentation. She noted that there was no evidence of post-Triassic or rejuvenation faulting along the boundary.

Evidence obtained on the present survey confirms Cameron's (1907) later interpretation. Near the boundary, the general dip, about 10°, of the Kholo beds increases to about 20° only; higher dips were recorded at only a few localities, where local faulting had occurred e.g. at 912805 Blackwall, where the dip is 45°. The strike of the Kholo beds is generally more or less parallel to the boundary.

Folding and Faulting

The Kholo sediments in their type area have been folded and faulted on a minor scale only. No simple pattern is evident.

The largest fold is the Kholo Anticline, in the Mount Crosby Formation and Colleges Conglomerate at 893810. It is a small fairly symmetrical anticline, pitching at about 5° to the south-east. The average dip in both flanks is about 10°. The length is 900+ yds and breadth 700+ yds. The eastern flank has been faulted at 901808.

A minor syncline in the Hector Tuff is exposed in the railway cutting at 910788 (Plate 3a). The axis strikes 70° grid, directly towards the strong fault (with similar trend) in the Hector Tuff in the railway cutting at 919792 (refer below). Drag effects are developed on the northern flank of the syncline, and a minor fault on the southern flank.

A minor fault, dipping northward at 45°, cuts the Weir Basalt at the entrance of a tunnel at 947822 Mount Crosby. In the tunnel, a fault dipping steeply southward, cuts off the basalt against Neranleigh-Fernvale beds.

The Blackwall Breccia appears to be little disturbed, except at 913806 Blackwall, where it dips away from its boundary with the Neranleigh–Fernvale beds at 60°.

A minor normal fault in the Mount Crosby Formation at 892816 Kholo, dips south-south-westward and cuts off the siltstone to the north against the shale to the south Crumpling of white shale in the lower (dark) shale member at 910805 Blackwall (Locality II) is attributed to bedding plane movements. Minor dip faults cut the Mount Crosby Formation at 892813 Kholo and 918807 Blackwall.

A normal strike fault cuts the Mount Crosby Formation on the road at 931813 Mount Crosby (Locality VI). It strikes 120° grid, dips south-south-westward at 50°, and is of unknown, though probably small, throw. It is filled with coarsely crystalline calcite, probably leached from the calcareous siltstone on its southern (downthrow) side.

Minor faults cut shale of the Mount Crosby Formation at the lower weir, 943811. One prominent strike fault strikes 130° grid, and dips south-westward at 55°. The throw is small, as similar shale occurs

on both sides of the fault. The fault has a maximum width of 8 in.; it is filled with angular fragments of shale, many of which show polished surfaces. Several minor faults lie parallel to this fault. About 15 yds to the south, the shale is cut by a minor strike fault, 3 ft wide, which dips northward.

The Colleges Conglomerate cropping out in the cliffs at 935797 may be faulted, for to the west it appears to dip eastward at 10°, whereas to the east it appears to lie horizontally. Jointing rather than faulting appears to have controlled the development of the cliffs of Colleges Conglomerate along the river south of the lower weir, and west of Colleges Crossing.

The Hector Tuff in the railway cutting at 919792 has been faulted extensively (Reid and Morton, 1922B) (Plate 3e–f). The most important fault is exposed in the eastern side of the cutting, 12 yds south of the road bridge. It is a normal oblique fault of small throw; it strikes 70° grid and dips north-north-westward at nearly 90°. The fault is about 6 in. wide; it contains fault breccia, composed of angular fragments of tuff of maximum size 60 mm, in a "flour" of finely ground tuff.

The Hector Tuff is also cut by the many dip and oblique faults which cut the Cribb Conglomerate. Twelve of these faults were mapped between Kholo Bridge and the eastern edge of the area surveyed. The maximum throw appears to be about 60 ft, at 894788.

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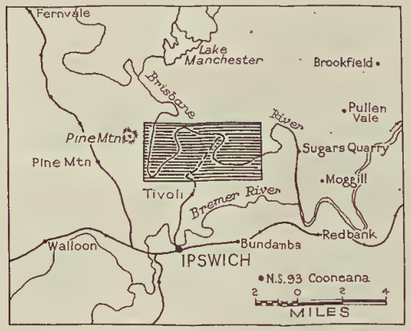
Geological Map
MOUNT CROSBY

R.J.Allen B.Sc.
Geological Survey of Queensland
1960

CHAINS 0 20 40 60 80
YARDS 500 0 500 1000 1500

Base-map prepared from uncontrolled aerial-photographic mosaic with grid of IPSWICH 1 mile military map superimposed

- geological boundary, position definite
- geological boundary, position approximate
- geological boundary, position inferred
- boundary of alluvial terrace
- fault with direction of throw
- fault
- inferred fault
- anticlinal axis, showing plunge
- anticlinal axis
- (II) stratigraphic section
- (B) fossil insect locality
- road
- track
- old permanent way
- creek, gully



LOCALITY MAP

QUATERNARY ?
- Qa Alluvium
- Qg High-level gravels

Unconformity

MIDDLE TRIASSIC
- Rmt Tivoli Formation
- Rmr Cribb Conglomerate
- Rmh Hector Tuff
- Rmc Colleges Conglomerate
- Rmm Mount Crosby Formation
- Rmw Weir Basalt
- Rmb Blackwall Breccia

KHOLO SUB-GROUP OF THE IPSWICH COAL MEASURES

Unconformity

LOWER PALAEOZOIC ?
- Pzn Neranleigh-Fernvale Group

J.A.W. 18.3.59

QUEENSLAND

DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 301

MICA CREEK PEGMATITES, MOUNT ISA, NORTH-WESTERN QUEENSLAND

By J. H. BROOKS, B.Sc., Geologist

BRISBANE

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MICA CREEK PEGMATITES, MOUNT ISA, NORTH-WESTERN QUEENSLAND

By J. H. Brooks, B.Sc., Geologist, and C. H. Shipway, B.Sc., Geologist

The Mica Creek pegmatites occurring in a linear belt some 9 miles in length near Mount Isa, though long known as the source of mica, tantalite, beryl, monazite and other minerals, had not until 1959 been subjected to any systematic investigation, though one or two localities had been inspected in some detail.

Reports of a number of new finds of beryl in 1958 prompted the decision to carry out a general geological survey of the entire pegmatite belt.

Though of widespread occurrence the mineral beryl is seldom found in commercial concentrations and reserves are disappointingly small. On the other hand there are prospects of commercial production of muscovite mica and the testing of one of the larger deposits is recommended.—A.K.D.

Abstract

The survey of the Mica Creek pegmatites was occasioned by the increased interest in the exploration and development of beryl deposits. The pegmatites are situated towards the western margin of the Precambrian mineral belt of North-Western Queensland, 4 to 10 miles south-west of the mining centre of Mount Isa.

Sedimentary and volcanic rocks of the Lower Proterozoic Eastern Creek Volcanics and Judenan Beds have been subjected to low-grade regional metamorphism and local high-grade thermal metamorphism. The thermal metamorphism resulted from the intrusion of the Sybella Granite to which the pegmatites are genetically related. The main pegmatite belt follows the near-meridional regional strike of the metamorphic rocks, and is 9 miles long and up to 2 miles wide.

Beryl occurs in segregated, concordant, granite pegmatite bodies. It is commonly present in the albitized feldspar or feldspar-muscovite zone, but has also been found along the margins of quartz cores. Nearly all the 79 tons of beryl which have been produced have come from the *Big Beryl* open-cut, although some recent production has come from the *Hexagon* group of deposits. In addition to beryl, 12·5 cwt. of mica have been produced and attempts have been made to produce tin, tantalite and monazite. Microcline and perthite segregations are a potential source of feldspar. Bertrandite, a member of the graftonite series, uraniferous columbite, native bismuth, bismutite and (?)absite are recorded for the first time from the Mica Creek area.

Small-scale production of beryl is expected to continue and there is some possibility of a future revival of mica mining. Inferred reserves of beryl which could be mined by open-cut methods do not exceed 50 tons.

Introduction

Purpose and Scope

A mineral resources survey of the Mica Creek pegmatites was made with emphasis on the occurrence of beryl. The recent increase in demand for beryllium resulted in renewed interest in the exploration and development of beryl deposits. Very small-scale production recommenced at the *Big Beryl* which was the only deposit to have been worked prior to 1958. Exploration has been carried out on many other beryl pegmatites, the most promising of which are those of the *Hexagon* group. This work has been done mainly by week-end prospectors and no deposits have been found which would support mining operations on anything but a very small scale.

Field mapping extended from 18th July to 16th August, 1959. Of this period, 13 days were spent in plane table mapping of the *Big Beryl* and *Hexagon* groups of beryl deposits on a scale of 100 ft. = 1 in., 8 days were spent on air photo mapping of approximately 50 square miles of the pegmatite belt and in the remaining 4 days a detailed study was made of the individual beryl pegmatites. For the air photo mapping a combination of R.A.A.F. photos, Mount Isa sheet, (1·3 in. = 1 mile, 1947), Adastra photos, Argylla and Hightville sheets (30 chains = 1 in., 1956) and Adastra photos, Mount Isa sheet (800 ft. = 1 in., 1958) was used. The R.A.A.F. photos were the only set to cover the whole area mapped and a topographical base derived from a controlled mosaic of these photos was used to compile the geological map of the area (Fig. 1).

Previous Mapping

No comprehensive survey of the pegmatite belt had previously been undertaken. Denmead (1937) described the occurrence of tantalite and mica, and Shepherd (1934, 1938, 1946) described the occurrence of mica and tin, and beryl at the *Big Beryl*

Big Beryl mine, looking north along the strike of the pegmatite. Open-cut in centre, middle distance. Outcrop of quartz segregation in centre, on skyline.

deposit. Early reconnaissance mapping was done by G. Hall and S. R. Carter of Mount Isa Mines Ltd. (Blanchard and Hall, 1942), and in 1946, mapping by geologists of Mount Isa Mines Ltd. included the north-eastern part of the pegmatite belt. Current detailed mapping by Mount Isa Mines Ltd. geologists also embraces the eastern part of the pegmatite belt although no specific study of the pegmatites is being made.

Acknowledgments

Messrs. A. R. Watson, N. Ebzery, E. Dainty and A. Czengody greatly assisted the survey through their detailed knowledge of the pegmatites. Mount Isa Mines Ltd. provided the loan of large-scale air photos which were of considerable help in compiling the geological map of the area. The assistance of Messrs. A. J. Saunders and G. McLellan, Inspectors of Mines, particularly in regard to transport, was greatly appreciated. Chemical analyses of samples were made by the Government Analyst, Brisbane. Miss B. R. Houston described 19 rock sections and Messrs. C. H. Shipway and L. G. Cuttler made qualitative analyses and optical examinations of mineral specimens. A selection of rock section descriptions is included as an Appendix to this report.

History and Production

The mica pegmatites were discovered as early as 1914 (Dunstan, 1916). A prospecting area was taken up at this time but there is no record of production till 1922. Twelve and a half hundredweight of mica valued at £805 were produced in the period from 1922 to 1927 but although a large number of exploratory pits and shafts were sunk, no large deposits of commercial grade mica were found and no further attempt at production has been made. In the 1937-38 period interest was aroused in the tin and tantalite pegmatites, but again, after several shallow shafts had been sunk, no commercial deposits were proved to exist. The demand for beryllium initiated during World War II resulted in the *Big Beryl* deposit being opened up. Production commenced in 1943 and has continued intermittently since that time. A total of 71·4 tons of beryl valued at £6,180 has been produced from this deposit up to 1958. Apart from this the only appreciable production of beryl has been from the *Hexagon* group of deposits which yielded 7·7 tons of beryl valued at £1,302 in 1958.

Topography and Drainage

The pegmatites are located in an area of low to moderate relief near the headwaters of Lena, Mica and Sybella Creeks which drain eastward into the West Leichhardt River. The height above sea level ranges from about 1,200 ft. to 1,500 ft. The divide between the inland and coastal drainage system is near the western margin of the area mapped. Quartzites and quartz "blows" form prominent meridional or near-meridional ridges, and schists and amphibolites underlie the intervening valleys. Pegmatites usually form low, rugged hills, and the granite area is one of low relief with sporadically distributed tors. Lena, Mica and Sybella Creeks have wide, sandy beds, but the only permanent water available is from "soaks" along the main branches of Mica Creek.

FIG. 1

MICA CREEK PEGMATITES

MOUNT ISA GOLD AND MINERAL FIELD — NORTH WESTERN QUEENSLAND

Geology by J.H. Brooks and C.H. Shipway Geological Survey of Queensland. August. 1959.

Topographic base map supplied by the Commonwealth Bureau of Mineral Resources

LEGEND

- Chlorite schist, subordinate amphibolite.
- Interlaminated quartzite, mica schist and chlorite schist.
- Muscovite schist, subordinate hornblende, biotite, chlorite, talc and tremolite schist.
- Hornblende schist, biotite schist and amphibolite, subordinate chlorite, muscovite and tourmaline schist and epidote quartzite.
- Quartzite, subordinate quartz-mica, chlorite and mica schist and amphibolite.
- Biotite-quartz gneiss with biotite schist remnants.
- Granite gneissic in part and including remnants of greisenized meta-sediments.
- P P Pegmatite with some interlaminated mica schist.
- Pegmatite dyke
- Q Quartz segregation
- BE Productive beryl pegmatite
- be Other beryl pegmatites
- T Tourmaline schist with large crystals of tourmaline.
- U Uranium
- 70° Strike and dip of schistosity
- Vertical schistosity
- Lithological boundary
- Trend line
- Fault
- Sh. 20' Shaft with depth
- Vehicle track

M.N.

Long. 139° 25° E.

Sediments in marginal zone

Some greisenized meta-sediments

Bulldozed Track

Columbite Rutile

Mica Apatite

Mica Pits

Some greisenized meta-sediments

Sybella (Templeton) Granite

Taringa

Garnet

Magnetite Vein

Disused Track

Lena

To Mt. Isa 4m.

BERYL NORTH

Bismuth Feldspar

Feldspar

Bulldozed Track

BIG BERYL

BERYL QUEEN

BERYL KING

HEXAGON

Mica Pits

LITTLE BERYL

"Emancipation"

Mica Pits Sh. 20'

Monazite Mica

Sh. 30'

Sh. 20'

Old Mica Camp

Creek

To Mt. Isa

Mica be Tantalite

Sh. 19'

Sh. 23'

Tin

Tin Sh.

Tin Sh. Pits

Mica Pits

Disused Track

20° 50' S. Lat.

Line of strongly Mica

Sh. 39' Tin

Silicified granite

Monazite Fluorite ? Absite

Mica Pits

OBAN RD.

Sh. Cu.

Sybella

C.J.L.

LOCALITY MAP

0 25 50 MILES

Leichhardt R.

MARY KATHLEEN

MT. ISA

CLONCURRY

Area Mapped

Townsville-Mt. Isa Rly.

DAJARRA

SCALE OF MILES

0 1/2 2

Access

The only graded road is the Oban Road which traverses the pegmatite belt in the Sybella Creek area near the southern extremity of the area mapped. A bulldozed track to May Downs property traverses the northern part of the pegmatite belt near Lena Creek and gives access to the *Big Beryl, Hexagon* and the western group of beryl pegmatites. A vehicle track also connects the old Mica Creek workings with Mount Isa and other little-used vehicle tracks connect the Lena Creek, Mica Creek and Sybella Creek areas along the valley in which the main beryl pegmatite belt is located. The distance from Mount Isa to the *Big Beryl* mine by road is approximately 6 miles. Mount Isa is 603 miles by rail from the port of Townsville.

General Geology

The Lower Proterozoic rocks of the area consist of metamorphosed volcanic and sedimentary rocks of the Eastern Creek Volcanics and the Judenan Beds which have been intruded by the Sybella (Templeton) Granite (see Fig. 1).

Granitic Rocks

The Sybella Granite is a composite intrusion which extends almost continuously over a meridional length of 110 miles and over a maximum width of 20 miles. It is described by Joplin (1955, p. 61). In the area mapped it consists largely of coarse-grained, gneissose granite with abundant pink microcline and subordinate quartz, biotite and oligoclase. Magnetite, fluorite and apatite are common accessory minerals and can sometimes be observed in the hand-specimen. The granite is more gneissose towards the margins, and where it is porphyritic with respect to microcline, augen-gneiss is developed. Near the margin of the granite a considerable amount of assimilation and greisenization of the meta-sedimentary rocks has taken place. Granular quartz-muscovite, quartz-sericite-fluorite and quartz-biotite rocks occur along much of the granite margin and these rock types also occur as remnants within the main granite area. The metamorphic banding of these rocks is usually still evident.

Biotite gneiss crops out in a belt extending north and south of the western group of beryl pegmatites. This gneiss has intrusive characteristics in many exposures and contains numerous deoriented biotite schist xenoliths. It is considered to have been formed by the hybridization of hornblende schist and granite. The mineralogical composition varies considerably from place to place. Biotite is always abundant but the ratio of feldspar to quartz shows a wide variation.

Metamorphic Rocks

Numerous metamorphic rock types are represented in the area as a result of thermal metamorphism and pneumatolysis of low-grade, regionally metamorphosed, argillaceous and siliceous sedimentary rocks and basic volcanic rocks. There are five lithological units which are represented on the geological map of the area (Fig. 1). From west to east these units are:—

1. Quartzite with subordinate quartz-mica schist, cordierite schist, mica schist, chlorite schist and amphibolite.

2. Hornblende schist, amphibolite and biotite schist with subordinate muscovite schist, chlorite schist, epidote quartzite, biotitite, tourmaline-muscovite schist and tourmaline-sillimanite schist.

3. Muscovite schist with subordinate hornblende schist, biotite schist, chlorite schist, talc schist and tremolite-actinolite schist.

Big Beryl area. Quartz segregation at Big Beryl mine on left, in middle distance.

4. Interlaminated quartzite, mica schist and chlorite schist.

5. Chlorite schist with subordinate amphibolite.

The chlorite schist, quartz-muscovite schist, tremolite-actinolite schist and quartzite are considered to be the product of low-grade regional metamorphism of argillaceous and siliceous sedimentary rocks. The amphibolite and hornblende schist are probably metamorphosed basalts in the main. Moderate to high-grade thermal metamorphism has resulted in the formation of local areas of biotite schist and biotitite from hornblende schist and amphibolite, and cordierite schist, tourmaline-sillimanite schist and tourmaline-muscovite schist from the argillaceous and siliceous meta-sediments. Pneumatolytic and thermal metamorphic processes have resulted in the formation of coarse muscovite schist, muscovite-tourmaline schist and biotite schist adjacent to the pegmatites.

Beryl crystal in the open-cut, "Beryl Queen" deposit. Length of crystal, approximately 4 feet.

Lithological units 1 and 2 are included in the Eastern Creek Volcanics and units 3, 4 and 5 in the Judenan Beds. No unconformity is evident between the two formations in this area. Nearly all the pegmatites are in lithological unit 2 and the remainder are in the biotite gneiss and the lithological units 1 and 3.

Structure.—The regional strike ranges from north-north-west to north-north-east and the regional dip is to the west at 75 deg. Dips as low as 35 deg. were recorded but the normal range of dip readings was from 65 deg. to vertical. Fold structures are relatively simple in the quartzite, amphibolites and other competent rock types but complex minor folding has taken place in the pelitic schists. The folds are mostly overturned to the west, and where they are not overturned, the east limbs of anticlines are either vertical or dip very steeply to the east. About one mile south of the *Big Beryl* there is an east-west, anticlinal crossfold axis. Around this axis of folding the schists exhibit complex minor folding and extensive shearing has taken place. The widest development of pegmatite coincides with the axial area of the fold.

On the eastern margin of the area mapped the Mount Isa Shear marks the junction between the Judenan Beds and the Mount Isa Shale. This Shear dips west with the upthrow on the western side. Other strike faults in the area are usually indicated by the presence of quartz "blows" along the line of faulting. There is a less important system of cross-faults. The principal directions of cross-faulting are north-west and north-east but there is little uniformity in the strike of these faults.

Pegmatites

Distribution and Occurrence

The Mica Creek pegmatites occur in a meridional belt 9 miles long and up to 2 miles wide adjacent to the eastern margin of the Sybella Granite. There are isolated pegmatites to the north of the area mapped, and to the south, the pegmatite belt is discontinuous and reduced in width. Isolated pegmatites occur along the eastern margin of the Sybella Granite as far south as the Dajarra area. There are also some pegmatites along the western margin of the Sybella Granite, 10 miles west of the Mica Creek area. Isolated beryl crystals are reported to be present in some of these pegmatites.

The largest pegmatite mass extends south-south-west from the *Big Beryl* mine over a length of 1·6 miles and a maximum width of 0·7 miles. At the southern end it adjoins the Sybella Granite. Elsewhere there are numerous, narrow, lenticular pegmatite dykes and sills. The great majority of the pegmatite bodies are concordant but transgressive pegmatites occur to the west of the large pegmatite mass referred to above. Lit-par-lit injection of pegmatite is not uncommon and a good example of this can be seen in the main pegmatite belt 1·4 miles north of the *Big Beryl* mine. The concordant pegmatites are regular in strike although often irregular in form. One concordant pegmatite extends from 1·4 miles north of Mica Creek to 1·2 miles south of Mica Creek and is in contact with the Sybella Granite over the whole of this length. It exhibits considerable variation in width but is usually not more than 200 ft. wide. The transgressive pegmatites are usually sinuous in strike but have a more regular form than the concordant pegmatites. One of these dykes is only 20 ft. to 30 ft. wide but is continuous over a distance of 1·2 miles.

FIGURE 3

BERYL PEGMATITES · MICA CREEK AREA

Mount Isa Gold and Mineral Field

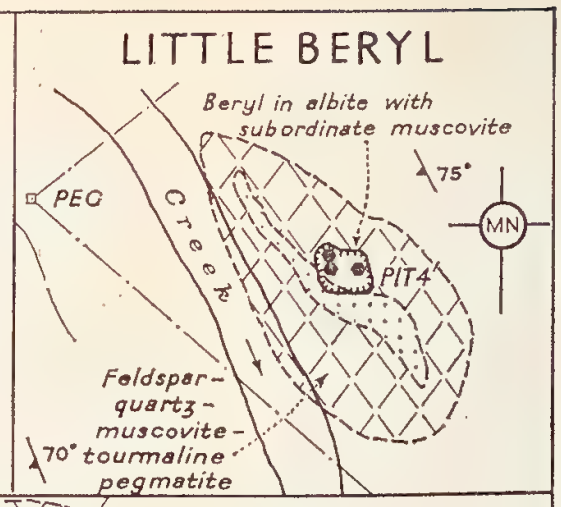
From Plane Table Survey by J.H.B. & C.H.S. July-August 1959

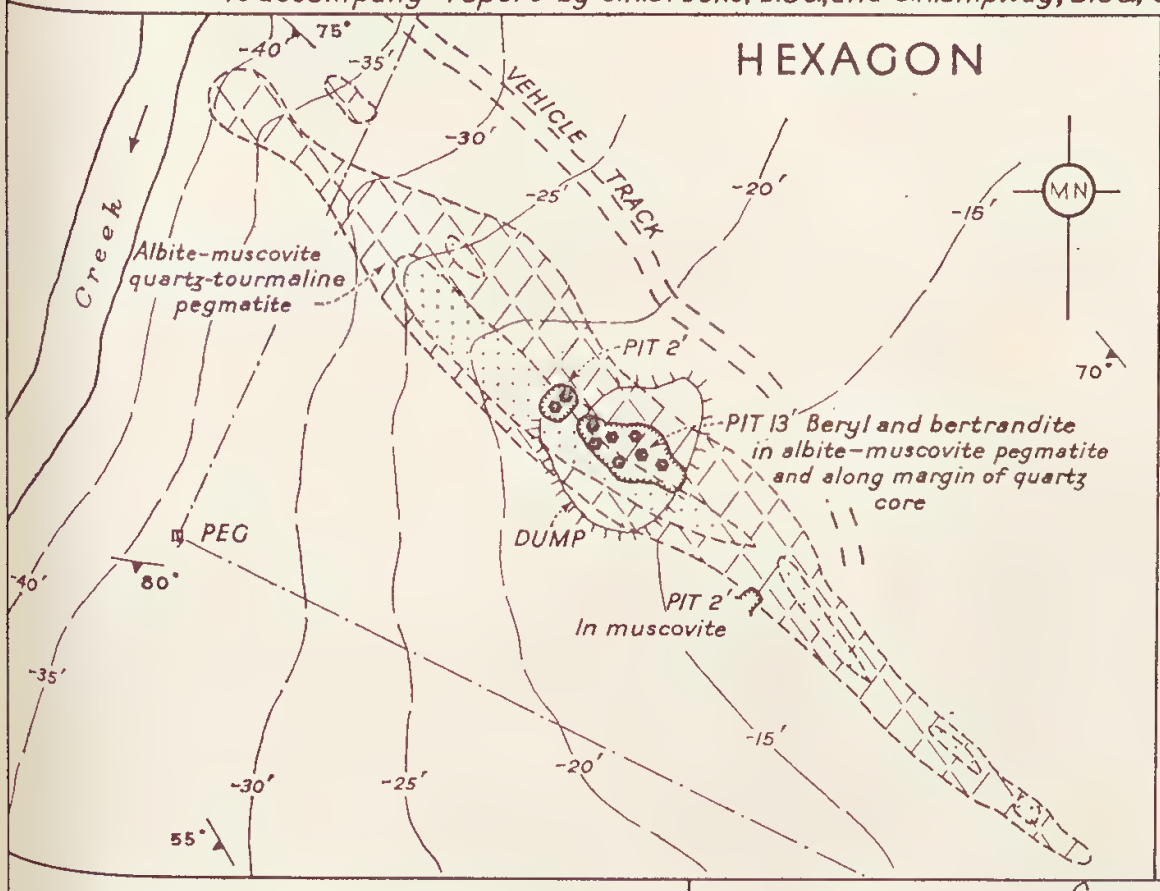
SCALE: 80 40 0 80 FEET

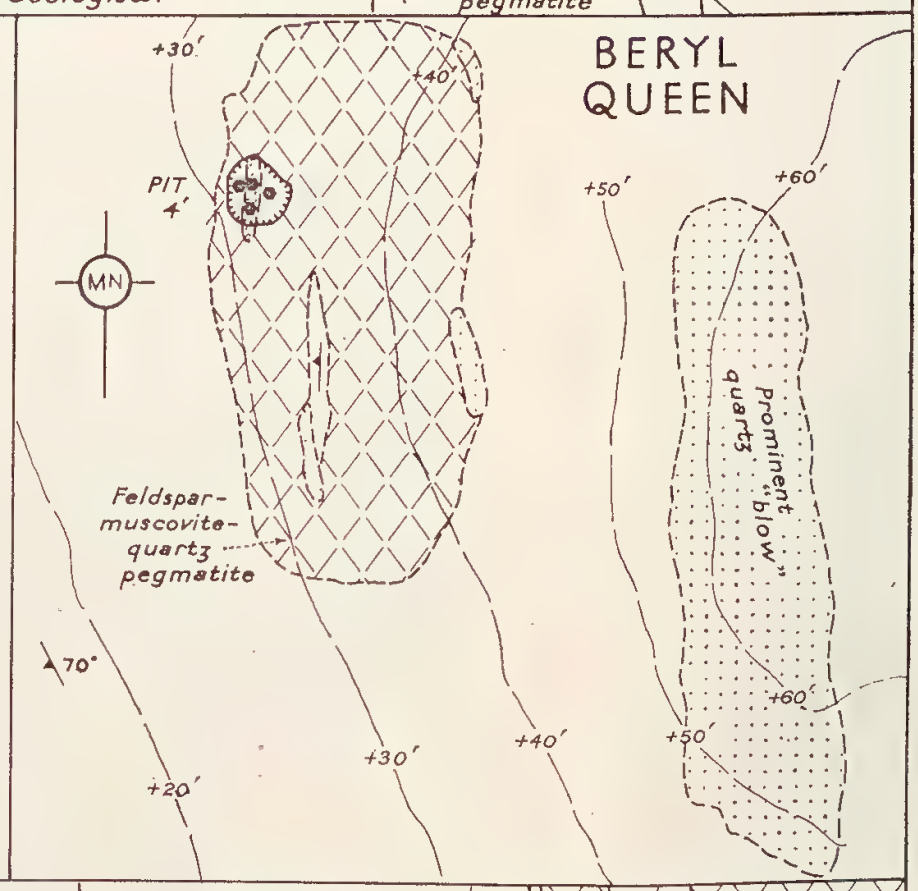
LEGEND

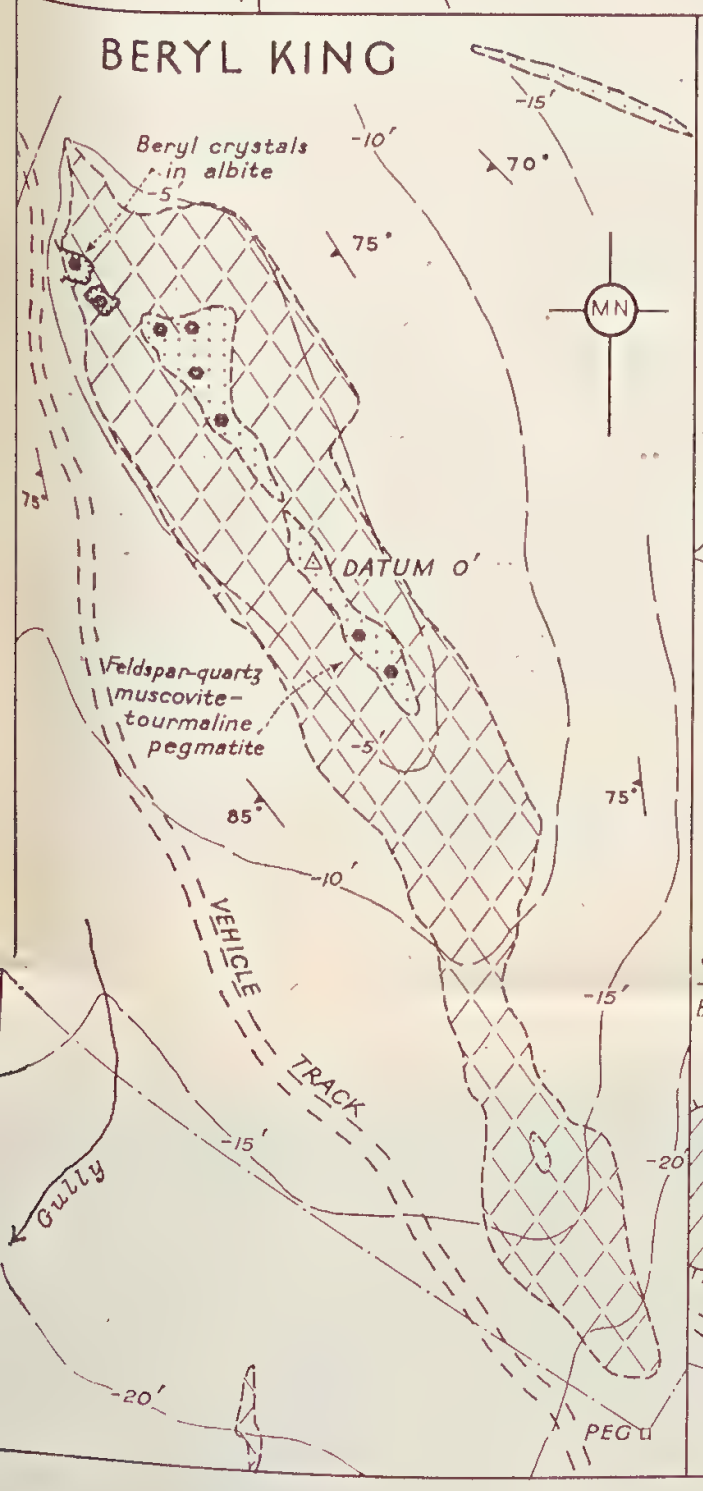
- Pegmatite
- Quartz segregation
- 70° Strike and dip of biotite, hornblende and muscovite schists
- Beryl crystals
- 6 Open-cut or pit with depth
- Dump
- 40' Contour line
- Lease boundary

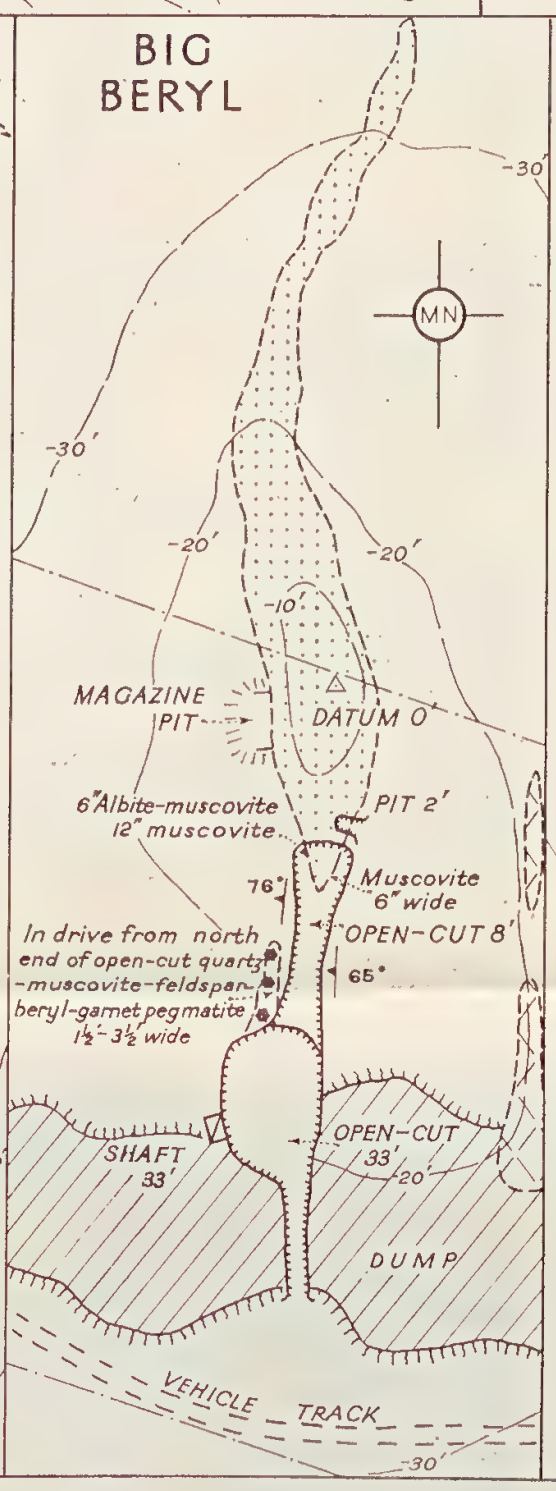
To accompany report by J.H.Brooks, B.Sc., and C.H.Shipway, B.Sc., Geologists.

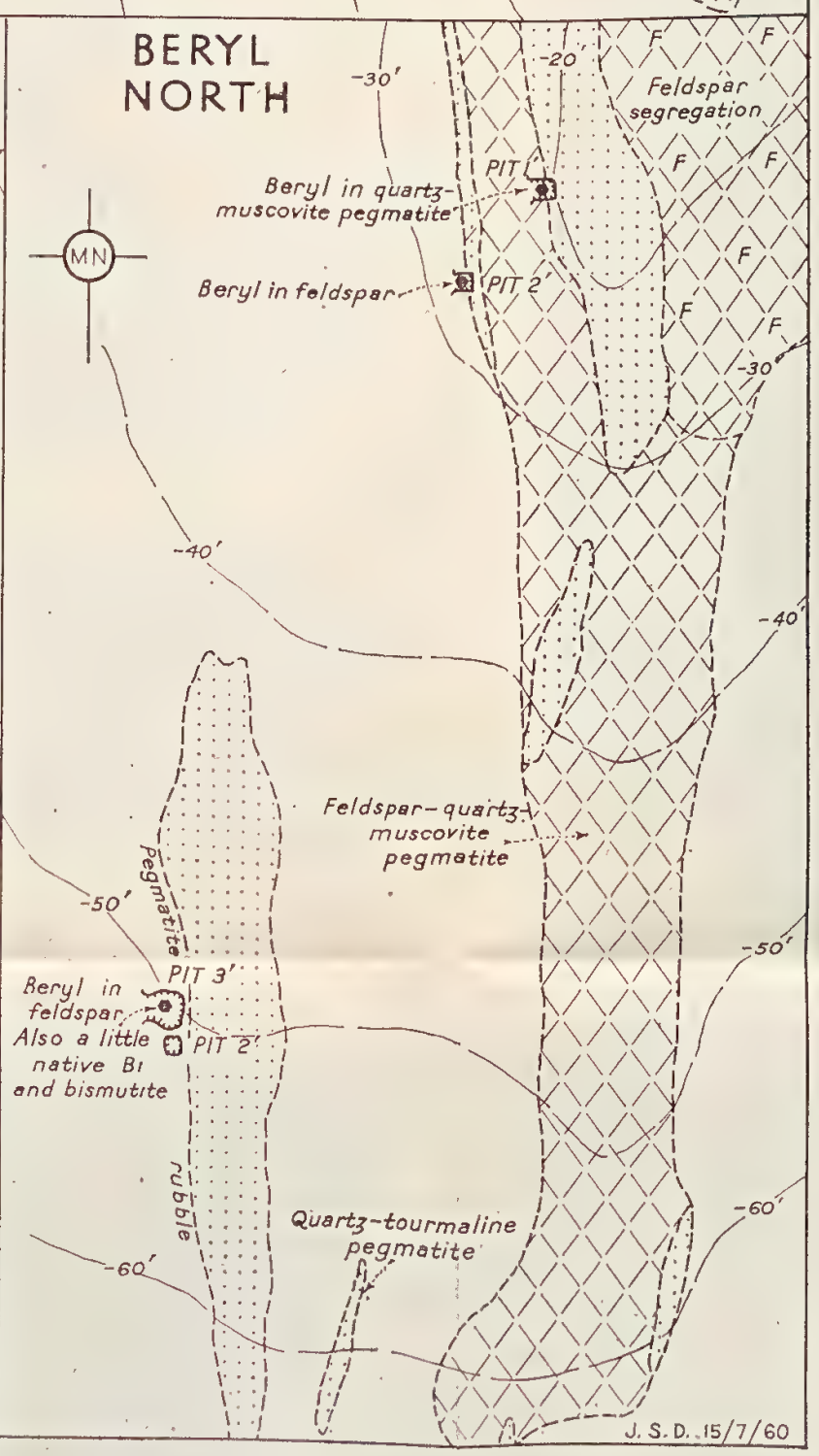












J. S. D. 15/7/60

Origin and Age

The spacial relationship and similarity in the main mineral constituents of the pegmatites and granite leave little doubt that the pegmatites are the product of the pegmatitic and pneumatolytic stages in crystallization of the Sybella granitic magma. The Mica Creek pegmatites diverge from the margin of the granite along a belt of basic schists. Metasomatic replacement of the schists by the pegmatite has taken place to a considerable extent in the large pegmatite bodies, but the narrow, lenticular sills and dykes appear to have been emplaced by dilatation along the schistosity of the metamorphic rocks rather than by replacement.

The age of the Sybella Granite and related pegmatites is considered to be late Lower Proterozoic although earlier intrusions may have taken place. Samples of monazite from the Mica Creek pegmatites were collected for age determination (Blanchard and Hall, 1942). The results were 1,000 million years by the Pb 208/Th 232 method and 1,190 ±400 years by the Pb 207/Pb 206 method (Faul, 1954). The samples were incorrectly listed by Faul as coming from the Mount Isa mine.

Pegmatite Minerals

Beryllium Minerals

Occurrence and Distribution

Beryl is known to occur in 25 pegmatites in the Mica Creek area. In 11 of these pegmatites only isolated crystals have been found. Yellow, pale green and pale amber are the most common colours but pale blue, white and pink beryl have also been observed. In some places it has a reddish colour due to iron-staining. The beryl usually occurs as well-formed, hexagonal crystals which have been found as large as 4 ft. long and 12 in. across. Fracturing of some crystals parallel to the basal plane has taken place and there is often a quartz in-filling on these fracture planes. Translucent to transparent beryl is not common but small crystals of acquamarine have been found in pegmatite near the May Downs property track, 2 miles west-south-west of the *Big Beryl*.

Beryl is largely confined to segregated pegmatites. Normally there is a quartz core surrounded by feldspar, feldspar-muscovite and muscovite zones. The beryl occurs mainly in the feldspar or feldspar-muscovite zone and along the adjacent margin of the quartz core. Less commonly it is restricted to either the quartz core or the feldspar-muscovite zone. There appears to be a relation between the introduction of beryl and the process of albitisation. Intergrowths of beryl and albite have been observed at the *Big Beryl* and several other beryl deposits. The occurrence and mineral assemblage of the Mica Creek beryl pegmatites closely resembles that of some overseas beryl pegmatites particularly those in North-Eastern Brazil (Johnston, 1945). However, Johnston considered that there was no direct relation between albitisation and the occurrence of beryl.

The main beryl pegmatites occur in an arcuate belt extending from one mile south of Mica Creek to one and a half miles north of Lena Creek, a distance of 6 miles. The larger deposits are centrally situated in this belt which has a maximum width of less than half a mile. The beryl pegmatites are conformable with the schistosity of the country rocks and they are nearly all within the belt of hornblende schists (lithological unit 2 see p. 5). A minor beryl pegmatite belt is located one mile west of the central section of the main beryl pegmatite belt and extends over a length of approximately one mile. The two belts are roughly parallel and are separated by granite and a large area of tourmaline-muscovite pegmatite.

Individual Beryl Pegmatites (see Fig. 2)

Big Beryl.—This deposit has been described by Shepherd (1946) and Brooks (1957), and a full description will not be repeated here. The beryl crystals are sporadically distributed in a small quartz-muscovite-albite-garnet-pegmatite at the southern end of a large quartz core. Recent production has come from a drive from the northern end of the main open-cut at a depth of 33 ft. The drive has been extended a distance of 22 ft. In the face of the drive the beryl pegmatite is 1·5 to 2·5 ft. wide and dips west at 70 deg. to 75 deg. in conformity with the surrounding biotite schist. The beryl is pale green or pale amber in colour, and is sometimes superficially stained reddish-brown. Very small amounts of transparent beryl have been obtained during the course of mining but no gem quality beryl has so far been produced for sale. Another feature of the beryl in this pegmatite is the close adherence of mica to the crystals. The total recorded production is 71·4 tons. No reserves can be estimated but small-scale production could probably be continued for several years. The mineral claim is now held by Mr. E. Dainty.

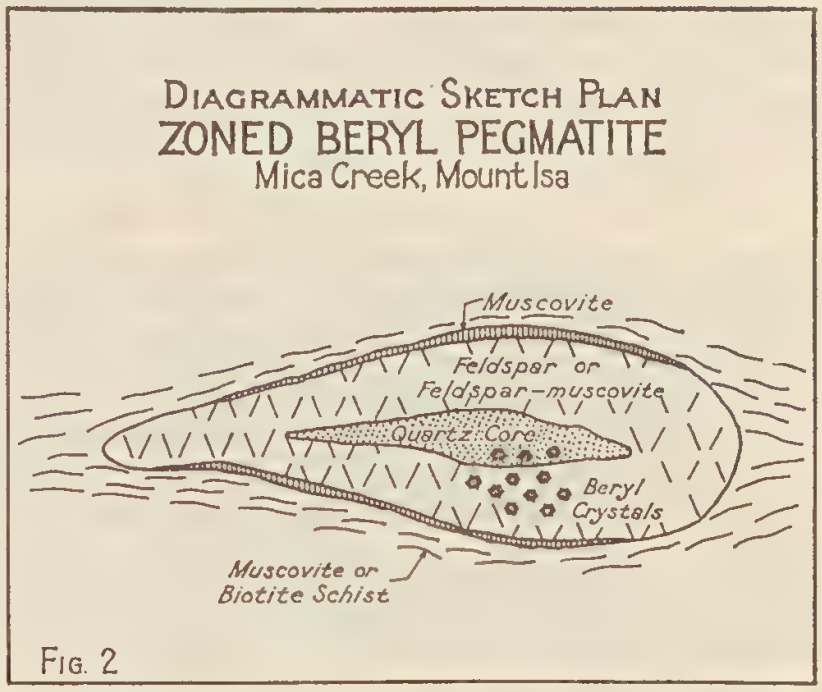


FIG. 2

Hexagon.—This is one of the recently-developed beryl pegmatites. The mineral claim is held by Messrs. Ebzery, Watson and Bowes. Well-formed, hexagonal beryl crystals occur in an albite-muscovite segregation and also along the margin of the adjacent quartz core. Hydrothermal alteration of some of the beryl has resulted in the formation of bertrandite (hydrated beryllium silicate), sericite and quartz. In some crystals the original hexagonal form has been retained but the

beryl has been partly or completely replaced by sericite and subordinate amounts of fine-grained bertrandite (Edwards *et al,* 1959). The bertrandite has, in turn, been partly replaced by mica. As far as is known this is the first recorded occurrence of bertrandite in Australia. Samples of hydrothermally-altered beryl ranged in assay from 13·1 per cent. BeO to 14·1 per cent. BeO. An analysis* of a typical sample is as follows:—

Silica (SiO_2)	54·9 per cent.
Iron oxide (Fe_2O_3)	2·6 per cent.
Alumina (Al_2O_3)	17·7 per cent.
Beryllia (BeO)	13·1 per cent.
Lime (CaO)	Nil
Magnesia (MgO)	0·9 per cent.
Potash (K_2O)	3·9 per cent.
Combined water (H_2O+)	5·2 per cent.
Hygroscopic water (H_2O-) ..	0·2 per cent.
	98·5 per cent.

Beryl crystals are as large as 3 ft. in length and 6 in. across. Pale blue and pale green beryl is present but pale amber beryl is most abundant. A small open-cut of maximum dimensions 30 ft. long, 15 ft. wide and 12 ft. deep has been excavated. Most of a parcel of 7·7 tons of beryl produced from the *Hexagon* group of deposits in 1958 was obtained from the open-cut. The outcrop of the deposit is 30 ft. above creek level so that open-cut mining could be extended to a considerably greater depth than the existing workings. Further small-scale production may be expected from this deposit.

Another beryl pegmatite is located 250 yd. south-east of the *Hexagon*. Small, pale yellow beryl crystals occur in a feldspar-muscovite segregation on the eastern side of a feldspar-quartz-muscovite-tourmaline pegmatite. Four pits have been excavated to a maximum depth of 3 ft. but no appreciable production has taken place.

Beryl King.—This deposit is in the *Hexagon* group. Beryl crystals are present in the quartz core and also in an albite segregation near the north-western end of the pegmatite. Elsewhere tourmaline-muscovite pegmatite and some graphic granite and aplite occur. Other minerals associated with the albite-beryl segregations are muscovite, a member of the graftonite series (phosphate of manganese, iron and calcium), epidote, tourmaline and manganese oxides. A description of graftonite is given in the section on Manganese Minerals. Less than one ton of beryl has been produced. Very little development has been carried out and further work may result in the production of a few tons of beryl.

Beryl Queen.—A small quartz segregation in pegmatite on the western side of a large quartz "blow" has yielded about half a ton of beryl. The main interest in this deposit attaches to the occurrence of a large, unusual crystal aggregate. It consisted of a central hexagon which was lying almost horizontally and along the length of the quartz segregation, and three lateral hexagons which diverged from one end of the central crystal to give a three-pronged affect. (Fig. 4). The potential production of the pegmatite appears to be very small. Workings consist of one small pit 4 ft. deep.

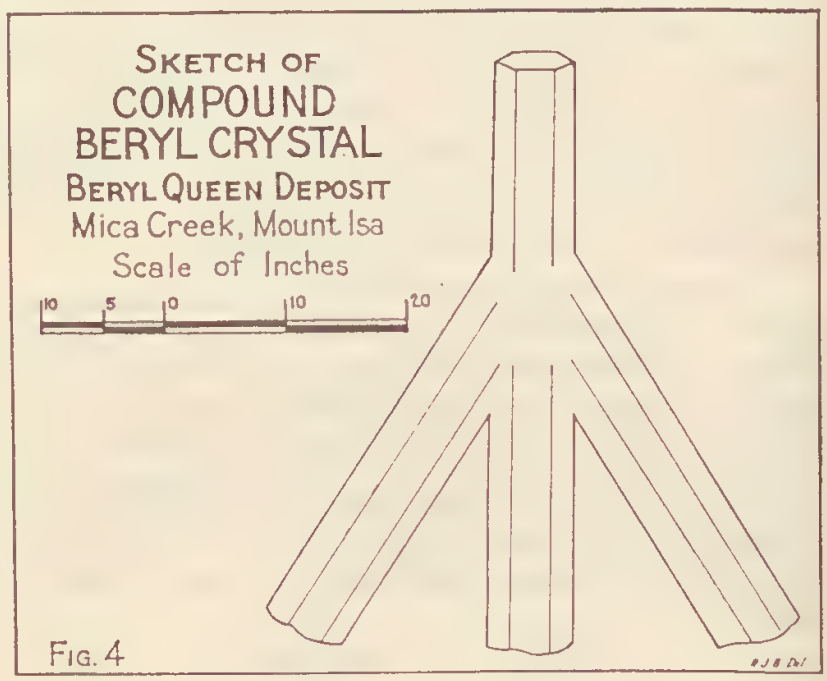


FIG. 4

Little Beryl.—This deposit is in a small pegmatite in the *Hexagon* group. A concentration of relatively small beryl crystals occurs in an albite-muscovite segregation and to a minor extent in the adjacent quartz core. A small pit 4 ft. deep has been opened up on the deposit. Some further production on a very small scale may be expected. The mineral claim is held by Messrs. Dainty and Groundwater.

Ebzery's deposit.—Beryl occurs in decomposed albite and to a lesser extent in the adjacent quartz core. The pegmatite is three-quarters of a mile south-east of the *Hexagon* and a little over a quarter of a mile north-west of the shafts on a biotite-monazite pegmatite described under Biotite and Monazite. One pit 10 ft. long, 4 ft. wide, and 4 ft. deep has been excavated on the deposit. Further development is warranted.

Czengody's deposit.—The deposit is situated about 200 yd. north-east of the old mica camp, three-quarters of a mile north-north-west of the mica-tantalite workings near Mica Creek. The beryl is confined to a muscovite-albite segregation along the western margin of a feldspar-quartz-muscovite pegmatite. A large number of relatively small, amber-yellow beryl crystals have been obtained from a pit 12 ft. long, 5 ft. wide and 6 ft. deep. The mica is pale silvery-green in colour. It was tested for lithium but negative results were obtained.

Southern beryl deposit.—This deposit is nearly one mile south-south-east of the mica-tantalite workings, and 150 yd. west of the disused track from Mica Creek to Sybella Creek. Beryl is largely restricted to the quartz core of a feldspar-muscovite-quartz pegmatite. The beryl is pale blue and translucent. One crystal was 4 ft. long, over 12 in. across and weighed about 2 cwt. Muscovite segregations in the same pegmatite have been

* Government Analyst, Brisbane.

prospected by shallow pits. A trench 15 ft. long, 3ft. wide and 2 ft. deep has been excavated on the beryl deposit. Only about a quarter of a ton has been produced and the potential production is very small.

Beryl North.—Several patches of beryl pegmatite have been located along the margins of a large, north-south striking pegmatite which extends north and south of Lena Creek. The beryl deposits are three-quarters of a mile north of the *Big Beryl.* Concentrations of beryl crystals are usually confined to albite segregations adjacent to quartz cores. However, one small beryl deposit is in a narrow, quartz-muscovite segregation at the margin of a large quartz core. Pale yellow crystals have been found up to 2 ft. long and 6 in. across. Small quantities of native bismuth and bismutite are associated with the beryl pegmatite at two points. Although less than one ton of beryl has been produced, this is one of the more promising beryl localities and scope exits for further exploratory and developmental work.

Far northern beryl pegmatites.—One and three-quarter miles north of the *Big Beryl* mine, and near the northern extremity of the area mapped, isolated beryl crystals have been found at several points in quartz-feldspar-muscovite-tourmaline-garnet pegmatite. Some small concentrations of pale yellow crystals have been found adjacent to narrow, marginal muscovite segregations or along the contact of quartz and muscovite-feldspar segregations. Beryl crystals are usually small but one crystal was 1 ft. long and 4 in. across. A few shallow pits have been sunk to explore the deposits. In one of these pits, situated less than 100 yd. west of the disused Spear Creek vehicle track, an intergrowth of massive, to imperfectly-crystalline, green and pink, opaque beryl was observed. Only a few hundredweight of beryl have been produced from this area.

Western beryl pegmatites.—The main deposit is one mile west-north-west of the *Hexagon* and a few hundred yards south of the track to May Downs property. Pale yellow beryl crystals up to 1 ft. long and 4 in. across are confined to a quartz core and none were observed in the adjacent feldspar segregations. There are isolated books of muscovite in the quartz and feldspar segregations. Two pits 5 ft. deep have been excavated on the deposit. Only about 3 cwt. of beryl have been obtained and the potential production is small.

Along the same line of pegmatite and on the northern side of the May Downs track there is a small deposit of pale green beryl on the contact of quartz and feldspar segregations. Tourmaline is abundant in the adjacent feldspar-quartz-muscovite pegmatite and some rose quartz was observed in the quartz core.

Mica

The occurrence of muscovite is almost ubiquitous in the Mica Creek pegmatites. Biotite is present in quantity at a few localities but no lepidolite has been identified.

Mica segregations of significant size are largely confined to a belt of pegmatite extending from near the *Beryl King,* 2·5 miles north of Mica Creek, to 3 miles south of Mica Creek. Numerous pits and shallow shafts have explored these deposits. There are also a few mica segregations in the western pegmatite belt, one mile west of the *Beryl King.* The mica segregations occur in the peripheral zone of the pegmatites (see Fig. 3) and the country rocks are muscovite schist or biotite.

The following is an analysis* of muscovite from the Mica Creek area.

Silica (SiO_2)	44·0 per cent.
Alumina (Al_2O_3)	33·6 per cent.
Potash (K_2O)	10·2 per cent.
Magnesia (MgO)	1·5 per cent.
Lime (CaO)	Nil per cent.
Iron oxide (Fe_2O_3)	5·0 per cent.
Manganese oxide (MnO)	0·2 per cent.
Combined water (H_2O)	4·7 per cent.
Moisture (H_2O)	1·0 per cent.
	100·2 per cent

Main Mica Localities.—1. Adjacent to the tantalite workings just south of Mica Creek. Large segregations of muscovite occur in this pegmatite with smaller segregations of feldspar and quartz. Tourmaline and a little beryl and garnet are associated. Some production of mica is believed to have taken place from these workings which consist of a shallow open-cut and a few small pits. Books of muscovite are as large as 10 in. square.

2. In cassiterite-muscovite pegmatite, a quarter of a mile south of Mica Creek. Fluorite, tourmaline and monazite are associated with this narrow, but persistent pegmatite. The muscovite segregations have been explored by three large pits which range up to 5 ft. in depth. The muscovite books are usually not more than 3 or 4 in. square.

3. Approximately one mile north-north-west of the mica-tantalite workings. This deposit has been described by Denmead (1937a, unpub.). Two shafts have been sunk to depths of 30 ft. and 20 ft. to prospect the mica segregation in a pegmatite which adjoins the Sybella Granite. The mica consists of interlocking books of biotite ranging up to 15 in. square with subordinate muscovite. A few hundred feet to the north in the same pegmatite prospecting pits have been sunk on a muscovite segregation. Small quantities of monazite and magnetite are also present in this pegmatite.

4. Approximately 1·75 miles north-north-west of the mica-tantalite workings, near the *Emancipation* uranium lease. Muscovite and biotite books range up to 4 in. square. Some feldspar and tourmaline are associated with the mica segregations which are adjacent to a quartz core. Workings consist of a prospecting shaft 20 ft. deep and a small open-cut 8 ft. deep.

* Government Analyst, Brisbane.

5. Two hundred yards south-south-east of the *Hexagon* open-cut, muscovite segregations occur around the margin of a quartz-muscovite-feldspar pegmatite. Four prospecting pits have been sunk to depths of up to 7 ft. The muscovite books are relatively small. A little beryl is also present in this pegmatite.

6. Approximately three-quarters of a mile north of the Oban Road crossing of Sybella Creek, a narrow quartz-muscovite segregation occurs at the margin of the Sybella Granite. Books of muscovite ranging up to 6 in. square are exposed in several pits which are up to 4 ft. deep.

7. In the western pegmatite belt, one mile west of the *Beryl King*, a biotite segregation occurs adjacent to a quartz core. Books of biotite as large as 12 in. square are exposed in two pits 2 ft. and 3 ft. deep. In the same area segregations of muscovite have been tested by prospecting pits. The muscovite books are of relatively small size. Apatite and tourmaline are also present in this pegmatite.

Monazite

Three monazite localities are known in the pegmatite which follows the margin of the Sybella Granite in the Mica Creek-Sybella Creek area. A fourth locality is 3 miles south of the area mapped in a continuation of the same pegmatite belt.

The most northerly occurrence is associated with a large mica segregation which has been described in the previous section (Mica locality No. 3). It is reported that a considerable amount of specimen monazite has been found in the mica rubble, but at the time of inspection only small pieces of monazite were observed. The specimens often exhibit prismatic crystal faces but there are no well-formed crystals. An assay of a sample of monazite from this locality indicated a thoria content of 6·8 per cent.

Some small grains of monazite have been found at several points along the cassiterite pegmatite extending south from Mica Creek for a distance of one mile. Large specimens obtained from this locality are described by Connah (1938).

Monazite is associated with fluorite and (?)absite in a quartz segregation 2·2 miles south of Mica Creek. Only very small pieces of monazite were observed, but it is reported that large specimens have been obtained from this locality. The monazite submitted by Mount Isa Mines Ltd. to the Geological Survey of Queensland (Blanchard and Hall, 1942) probably came from this locality or the cassiterite pegmatite locality. The results of 4 assays ranged from 5·73 per cent. to 6·22 per cent. thoria* (For the results of age determinations on these samples see p. 7).

Large specimens of monazite have been found as floaters in quartz rubble three-quarters of a mile south-east of the Brown's Creek crossing on the Oban Road. The specimens are reddish-brown in colour and often exhibit imperfectly-developed prismatic faces. Quartz surrounded by a feldspar-muscovite segregation crops out nearby but no monazite was seen *in situ*. Several hundredweight of monazite have been collected. A sample of monazite from this locality assayed 7·1 per cent. thoria.

Feldspar

The feldspar of the pegmatites consists largely of pink and white microcline and perthite. Feldspar segregations commonly occur as an envelope round a quartz core (see Fig. 2) and may in turn be enveloped by a muscovite segregation. There are not many large, uncontaminated feldspar segregations. Usually muscovite and/or quartz is present in subordinate amounts. Large, relatively-pure, microcline-perthite segregations are located a half to three-quarters of a mile north of the *Big Beryl* mine (Shepherd, 1946). One deposit is estimated to contain 25,000 tons of feldspar which could be readily quarried and there are at least two other somewhat smaller deposits. A rather unusual occurrence is that of pale green perthite in a pegmatite zone on the margin of the Sybella Granite, half a-mile north of the Sybella Creek crossing on the Oban Road. Graphic intergrowths of microcline and quartz are common although the graphic material usually forms only a mall part of the pegmatite with which it is associated.

Albite-oligoclase is less abundant than the microcline and perthite and it is often associated with beryl. Unfortunately the albite segregations containing beryl are not large enough or of sufficient purity to consider producing the feldspar as a by-product of beryl mining.

Cassiterite

The cassiterite-bearing pegmatite in the Mica Creek area is the only recorded occurrence of tin in the Cloncurry-Mount Isa Mineral Fields. The pegmatite and the extensive prospecting workings are decribed by Shepherd (1938). Black, granular cassiterite is associated with muscovite in a feldspar-muscovite-quartz pegmatite containing minor amounts of tourmaline, fluorite and monazite. Cassiterite occurs intermittently in the pegmatite over a distance of nearly 1·5 miles. The richer section is adjacent to Mica Creek on the old *Lithgow* and *May Downs* leases. Systematic sampling was carried out by Anglo-Queensland Mining Proprietary Ltd. in 1938. The pegmatite averaged 0·27 per cent. tin over a length of 468 ft. and an average width of 5 ft. Small lenses of cassiterite pegmatite contain up to 10 per cent. tin but these lenses are too small to encourage development of the deposits.

Tantalite-Columbite

Tantalite-columbite minerals are known from two localities. The occurrence near the mica workings just south of Mica Creek has been described by Denmead (1937b). Tantalite is associated with quartz in a muscovite-albite-quartz pegmatite.

* Government Analyst, Brisbane.

A lease known as the *Ida May* was taken up and a shaft was sunk 19 ft. but the tantalite-bearing pegmatite cut out at this depth. There appears to be no prospect of production.

Crystals of manganiferous columbite from the western pegmatite belt have been described by Connah (1938). A specimen of columbite containing 0·7 per cent. U_3O_8 was submitted to the Geological Survey of Queensland during the uranium boom of 1954. The specimen came from the Mount Isa area and the collection during the present survey of a specimen of manganiferous columbite exhibiting weak radioactivity confirmed the occurrence as being from the Mica Creek pegmatites. The manganiferous columbite specimen was collected from rock rubble adjacent to a beryl pegmatite approximately one mile west-north-west of the *Hexagon*. No columbite was observed *in situ*.

Quartz

Quartz segregations are common in the Mica Creek area. In many cases they form prominent outcrops known locally as "quartz blows." In many places the quartz is present as the core of a segregated pegmatite. Elsewhere quartz has been intruded along fault lines. Some of the "quartz blows" have abundant, needle-like, tourmaline crystals associated with them and small bodies of quartz-touramline rock are of widespread occurrence. In the Spear Creek area, 4 miles beyond the northern limit of mapping, a "quartz blow" has been quarried by Mount Isa Mines Ltd. for use as silica flux in copper smelting. No quartz crystals of commercial quality have been found. The quartz is usually milky-white although some rose quartz has been observed.

Tourmaline

After quartz, feldspar and mica, this is the most abundant of the pegmatite minerals. Few of the pegmatites are completely devoid of tourmaline. Prismatic crystals range up to 1 ft. in length and up to 3 in. across. In addition to tourmaline pegmatites there is a fairly extensive development of tourmaline schists. These schists are confined to the belt of hornblende schist, biotite schist and amphibolite (lithological unit No. 2 see p. 4). Several localities are noted on Figure 1. Muscovite, sillimanite, chlorite and sericite are associated with the tourmaline. Well-developed crystals exhibit the hexagonal prism, trigonal prism and trigonal pyramids. On the weathering and decomposition of the tourmaline schists the tourmaline remains to form detrital deposits and well-formed crystals of museum specimen quality can be obtained.

Iron Minerals

Magnetite and hematite are of common occurrence in the pegmatite belt but there are no deposits of any possible economic significance. A magnetite vein over 100 ft. long and up to 1 ft. wide is associated with a small quartz segregation approximately one mile north of the *Big Beryl*. Detrital magnetite and hematite is often abundant in the vicinity of pegmatite outcrops.

Titanium Minerals

Specimens of rutile from the old *Marrickville* lease, 3 miles north-west of the mica-tantalite workings near Mica Creek, were described by Connah (1938). Dark reddish-brown to almost black crystals of rutile were found in association with quartz and mica schists. Ilmenite in quartz has been identified from the muscovite-tantalite pegmatite near Mica Creek and specimens of hematite, magnetite and tantalite from several widely separated localities have been found to be titaniferous.

Manganese Minerals

A phosphate of manganese, iron and calcium which has been identified as a member of the graftonite series occurs in an albite-beryl-muscovite pegmatite at the *Beryl King*. Coarse, anhedral crystals of the mineral are encrusted by manganese oxides and may also have a very thin encrustation of a mineral with the appearance of rhodonite (for a full description see Appendix.) A chemical analysis of the mineral is tabulated below and an analysis of graftonite from Grafton, New Hampshire, U.S.A. is included for purposes of comparison.

—		Mica Creek Sample*	Grafton U.S.A. Sample (Palache *et al* 1951)
		Per cent.	Per cent.
Manganese oxide	MnO	35·9	17·62
	FeO	15·2	30·65
Iron oxide	Fe_2O_3	0·4	..
Lime	CaO	5·1	9·23
Magnesia	MgO	1·2	0·40
Phosphate	P_2O_5	40·8	41·2
Water	H_2O	0·7	0·75
Remainder	..	0·2	0·33
Totals		99·5	100·18

A limited isomorphous series extends between the manganese, iron and calcium (Palache, *et al*, 1951). The combined percentage of manganese oxide, iron oxide and lime in the analyses of samples from Mica Creek and Grafton, U.S.A., is 56·6 per cent. and 57·5 per cent., respectively. The main difference in chemical composition between the samples from the two localities is that the ratio of manganese to iron is almost reversed.

The occurrence of manganiferous columbite and manganiferous apatite is referred to in the sections on Tantalite-Columbite and Apatite.

Bismuth Minerals

Small quantities of native bismuth and the yellowish-green carbonate, bismutite were found by Messrs. Ebzery and Watson in the course of the exploration of beryl deposits three-quarters of a mile north of the *Big Beryl* deposit. The minerals are exposed in two shallow pits, one on the eastern side and the other on the western side of the main pegmatite belt just north of the main branch of Lena Creek. The bismuth minerals are of no economic significance but this is the first record of bismuth in the Mica Creek pegmatites and one of the few occurrences of bismuth in the Cloncurry–Mount Isa Mineral Fields.

* Government Analyst, Brisbane.

Uranium Minerals

Although several occurrences of uranium are known in the hornblende schist and amphibolite of lithological unit No. 2 (see p. 6), uranium minerals are rare in the pegmatites. Uraniferous columbite has been referred to under Tantalite–Columbite. A mineral with the physical properties of absite is associated with monazite and fluorite along the margin of a quartz segregation 2·5 miles south of the mica-tantalite workings near Mica Creek. Small, green, resinous, translucent grains of (?)absite were observed mainly in detrital material in the vicinity of the quartz segregation.

Garnet

Red garnet is widely distributed in the pegmatites and it is most abundant in the pegmatite belt extending north from the *Big Beryl* area. There is a concentration of large almandite crystals in a pegmatite 1·5 miles north of the *Big Beryl*. The crystals range up to 2 in. in diameter and exhibit imperfect rhombdodecahedral and trapezohedral forms. They usually have a superficial stain of manganese oxides. Smaller garnet crystals are abundant in a pegmatite less than 100 yds. south-east of the *Big Beryl* open-cut.

Fluorite, Apatite, Epidote, Topaz

Fluorite is not abundant but it occurs at several places in the pegmatite adjacent to the Sybella Granite, from the cassiterite workings at Mica Creek for a distance of 2·5 miles to the south. The fluorite is usually purple in colour but may be almost colourless. A small deposit of colourless fluorite has been found in granite near Mica Creek a few miles upstream from the tin pegmatite.

Deep green apatite crystals are associated with quartz in a muscovite-rich pegmatite, one mile west-north-west of the *Hexagon* deposit. Imperfectly-formed, hexagonal crystals up to 2 in. across are exposed in shallow pits sunk to test the muscovite. Manganiferous apatite associated with beryl from the Mica Creek pegmatites was identified by Connah (1939).

Epidote is a widespread minor constituent of the metamorphic rocks of the area but is not a common mineral in the pegmatites. It is present in association with albite, muscovite and beryl at the *Beryl King* and *Hexagon* deposits.

No topaz was collected during the recent survey but it has been recorded in the Mica Creek pegmatites (Connah, 1938). Specimens were described as "topaz rock veined with fluorspar."

Economic Aspects

Beryl.—In the 1957-1959 period the assured market for beryl* aroused interest in the *Big Beryl* and some previously undeveloped beryl pegmatites. The 1959 price of £15 9s. per unit of beryllia (f.o.b. main Australian ports) compares favourably with the price of £2 9s. to £2 19s. 6d. per unit of beryllia obtained in the 1942-44 period (Sullivan, 1945). However, in view of the scarcity of beryl this price still does not provide much inducement for exploration for new deposits or the systematic development of known deposits.

On present indications, the Mica Creek beryl pegmatites are not capable of supporting mining operations on anything but a very small scale. Unfortunately no other valuable minerals are directly associated with the beryl—elsewhere in Australia beryl is produced as a by-product from the mining of tantalite (Wodgina, Western Australia) or feldspar (Thackaringa, Broken Hill). In view of the small size and relatively low grade of the Mica Creek beryl deposits, it is improbable that they could be profitably mined by underground methods when the reserves available by open-cut mining are exhausted. In common with other pegmatite deposits no accurate estimate of reserves can be made. However, it is considered that the amount of beryl obtainable by open-cut mining would not exceed 50 tons.

In many of the beryl pegmatites all the floater material and the exposed beryl crystals have been collected. This will add to the difficulty of future exploration for beryl, but the maps accompanying this report may assist in indicating pegmatites which would warrant further exploration if the demand for beryl continues to increase.

Mica.—Although early attempts to establish a mica mining industry met with little success there is still a possibility of future production. It is difficult to form any appraisal of the quality of the mica on present indications as the mica books are all extensively weathered and iron-stained. A considerable amount of work would be required to clean out the old pits and shafts and expose fresh books. However, in view of the present demand for muscovite and the fact that no tests for commercial suitability have been carried out on muscovite from Mica Creek for over 30 years, it is considered that the reopening of one of the larger deposits to obtain fresh samples is warranted.

Monazite.—No production has taken place but an attempt is being made to produce a trial parcel of ore from the deposit in the Brown's Creek area. It is not expected that any more than a few tons of monazite could be produced.

Tin.—Prospecting of the cassiterite pegmatite has been carried out by private prospectors and by Anglo-Queensland Mining Proprietary Ltd. The results of this work indicate that profitable production could not take place in the forseeable future.

Feldspar.—The large feldspar segregations north of the *Big Beryl* mine could be easily exploited by open-cut methods. One deposit is estimated to contain 25,000 tons. However, the deposits are too remote from the market to enable economic development at the present time.

* Up to the end of 1959. the total Australian production of beryl was bought by O. T. Lempriere & Co. Ltd. as agents for the Commonwealth Government and the United Kingdom Ministry of Supply.

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APPENDIX: MICROSLIDE DESCRIPTIONS

By Miss B. R. HOUSTON, B.Sc., Geologist

Microslide GSQ 468, ex GSQ/R 498.

Location.—150 yards east of *Big Beryl* Mine.

A massive, black and white mottled rock.

In thin section, an uneven-grained rock composed of subhedral to euhedral, stout, prismatic, unoriented poikiloblasts of hornblende, averaging 0.75 mm. in length, set in a fine-grained (0.07 mm. average) granoblastic, quartzo-feldspathic matrix. Some fine, subhedral hornblende is also present in the matrix and probably represents the beginnings of growth of a second generation of hornblende.

The dominant constituent, *hornblende*, is pleochroic from yellowish-green to bluish-green to greenish-brown and is probably actinolitic in composition. The depth of colour in the finer crystals is not so great as in the coarser.

The *plagioclase* which, with a small amount of *quartz*, composes the matrix is weakly-twinned, if it is twinned at all. Both minerals are fresh and have few, if any, inclusions.

Minor amounts of fine, euhedral *apatite* and *magnetite?* are present in the matrix together with accessory *epidote*. *Limonite-* and *hematite*-staining are marked, particularly near the epidote.

Name.—amphibolite.

Microslide GSQ 459, ex GSQ/R 469.

Location.—Two miles north-north-east of the *Big Beryl* mine.

A massive, dark-grey, fine-grained lustrous rock containing numerous "pods" (commonly about 7 mm. x 15 mm.) of cream-coloured material. These "pods" have siliceous cores with an outer rim of quartzo-feldspathic material, sometimes with ferromagnesian minerals also.

In thin section, the rock consists predominantly of a network of fine (0.3 mm.), subhedral, unoriented hornblende crystals with a fine (0.07 mm.), granoblastic, quartzo-feldspathic matrix.

The *hornblende* is pleochroic from greenish-yellow to deep blue-green. It is probably actinolitic. Accessory opaques are associated with the amphibole.

The matrix is composed essentially of *plagioclase* with some *quartz*. The feldspar is untwinned or weakly twinned and is very fresh.

Accessory euhedral *apatite* is present.

The "pods" are composed of fresh, allotriomorphic-granular (granoblastic?), quartzo-feldspathic material with minor altered hornblende. They become more siliceous towards the centre.

It is believed that this rock was derived from a porphyritic basic volcanic; thus the "pods" would represent feldspar phenocrysts which had undergone some process of metamorphic differentiation.

Name.—amphibolite.

Microslide GSQ 462, ex GSQ/R 477.

Location.—Near margin of Sybella Granite in Mica Creek Area.

A dark-grey lustrous rock with a well-developed schistosity. Basic copper carbonate mineralization is a surface feature only.

In thin section, the texture is nematoblastic and the dominant constituents are hornblende (about 85 per cent.) and plagioclase.

The *hornblende* occurs as slender prisms, about 1 mm. in length, arranged with a regular parallelism. Some stouter poikiloblasts, up to 6 mm. in length, are also present. Pleochroism is in shades of green; the composition is probably actinolitic.

The *plagioclase* occurs as lenticular areas, averaging 0.3 mm., surrounded by parallel hornblende crystals. The feldspar is, in general, very fresh though some is sericitised. Twinning is weak.

Quartz occurs similarly to the plagioclase but in minor amounts only.

Epidote occurs as fine anhedra (about 0.025 mm.) and is pleochroic from colourless to greenish-yellow.

Sphene, anhedral to euhedral in form, occurs in slightly greater than accessory amounts.

Apatite occurs as fine euhedral crystals in accessory amounts only.

Limonite-staining is relatively widespread particularly along fractures in the epidote.

Name.—hornblende schist.

Microslides GSQ 478, 479, 480; ex GSQ/R 509.

Location.—Prospecting pit at northern end of *Beryl King* mineral claim.

A pinkish-brown coloured, vitreous to slightly resinous, massive, strongly-fractured mineral with a partially enveloping "skin" of manganese oxides. H = 5. Sp. Gr. = 3.719.

In thin section the mineral is colourless and the fractures are marked and uneven. It is biaxial, optically positive; 2V = 56° (approximately); retardation = 1370 μ (approximately); maximum birefringence is high, about 0.27. Suitable equipment was not available for the accurate determination of the refractive index; in a section of which the refractive index appears not to change upon rotation, a value of 1.697 was measured, i.e. γ = 1.697 (approximately).

A series of stringers of a red-brown, green or almost colourless birefringent mineral which is transparent to translucent, traverse the mineral especially near its outer edges. Some opaque manganese ? oxides are associated with this material.

Name.—A member of graftonite isomorphous series.

Microslide GSQ 466, ex GSQ/R 488.

Location.—In pegmatite belt, 3 miles south of Mica Creek.

A light-green, siliceous rock which appears to have a granitic texture.

In thin section, the rock consists of an allotriomorphic-granular, quartzo-feldspathic mosaic with an average grain size of about 1 mm.

The essential constituents are *quartz* and about 40 per cent. highly sericitised *feldspar* which was probably potassic.

Muscovite occurs either as a rim to areas of sericitised feldspar or as solitary interstitial flakes.

Accessory, anhedral, purple *fluorite* is also present.

Name.—greisen.

Microslide GSQ 460, ex GSQ/R 474.

Location.—Margin of Sybella Granite, 2 miles north of Sybella Creek.

A massive, pink and white mottled, gneissose rock in which feldspar, quartz, mica, and pyrite are readily identifiable. Crude foliation is apparent about relatively coarse, lenticular "eyes" of potassic feldspar (long axis about 1 cm.).

In thin section, a fairly even-grained rock with an average grain size of about 0.5 – 1 mm. The minerals are all anhedral.

Quartz, the dominant constituent occurs, in general, as clouded sheaf-like growths which have no preferred orientation.

Feldspar is the only other constituent of any significance. Microcline is slightly in excess of plagioclase (oligoclase).

Muscovite occurs as flakes. Minor amounts only are present. Highly altered, greenish-brown *biotite* is slightly more abundant. Minor green *chlorite* may be associated with the biotite.

Secondary *silicification* has taken place on a minor scale.

Name.—gneissic granite.

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DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

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BEACH SAND HEAVY MINERAL DEPOSITS OF QUEENSLAND

By T. H. CONNAH, M.Sc., Senior Geologist

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PREFACE

This comprehensive account of beach sand mining in Queensland, besides its obvious appeal to those engaged in the mineral industry, has also much to interest students of changing land forms and coastal erosion. The paper can in a sense be regarded as the Queensland counterpart of the admirable report put out in 1959 by H. F. Whitworth which while covering all of Eastern Australia was nevertheless based largely on a study of the New South Wales deposits.

In compiling the report Mr. Connah had access to and made free use of a large number of unpublished company records filed at the Department under the terms of Authorities to Prospect. Acknowledgement is made of the co-operation of the various organizations engaged in the beach sand industry in supplying additional data and also in giving every facility in the field to Mr. Connah and other Departmental officers.

The two main products of beach sand mining, rutile and zircon, have been useful export income earners, value of the production in the ten year period 1951-1960 having exceeded 13 million pounds. The persistent low market value of these minerals following the price collapse in 1957 has led to selective mining of better grade material in some deposits of low average grade. However the low prices have also focussed attention on operating costs with encouraging results; and there is now every reason to expect that with prices stabilized not greatly above existing levels the profitable treatment of the large low grade deposits on North Stradbroke Island and elsewhere may become a reality.

A. K. DENMEAD,
Chief Government Geologist.

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BEACH SAND HEAVY MINERAL DEPOSITS OF QUEENSLAND

By T. H. CONNAH, M.Sc., Senior Geologist

ABSTRACT

A review of beach sand heavy mineral deposits and natural concentration processes is based on the results of State-wide investigations by private interests during the rutile boom of 1955-57 and on detailed study by the author of the coastal strip between Coolangatta and Fraser Island which contains our major resources. With few exceptions, concentrations of possible economic interest are confined to present and past shore-lines and associated dunes. Those parts of the coastal plain which represent raised sea-bed or lagoons, where tested, contain uniformly very small proportions of heavy mineral. Northwards from Fraser Island, under the influence of the Great Barrier Reef, wave concentration is on a greatly reduced scale and beyond Cape Clinton no important deposits are known.

With the exception of the giant dunes of south-east Queensland there is virtually no preservation of strand deposits prior to the mid-Recent emergence of some 20 ft. It would appear that economic concentrations are almost everywhere associated with sea levels at or close to the present level. The high dunes of North Stradbroke provide an important exception containing the greatest known reserves in concentration somewhat below presently workable limits.

The deposits south from Moreton Bay, extending into New South Wales, are of world distinction for their high proportions of rutile and zircon. Northwards, ilmenite becomes predominant and beyond Fraser Island zircon and rutile assume insignificant proportion except for one or two small Peninsula deposits.

The rich deposits of the Gold Coast area south from Southport are now virtually exhausted, and the future of the industry lies essentially in the large sandy islands of the southern coast, which contain large reserves in low-grade deposits. Occurrences north from Fraser Island contain a substantial aggregate tonnage of low-chrome ilmenite, though no one area is known containing sufficient reserves to be attractive for development solely as a source of ilmenite under present conditions.

PART 1

INTRODUCTION

Beach sand mining in Eastern Australia experienced a boom in the years 1952-57 as a result of a buoyant market for rutile. In Queensland, in addition to expansion of mining in the Southport–Coolangatta area and on North Stradbroke Island, prospecting was extended to areas further north, in some of which the presence of black sand had already been established. In a wave of fever-pitch during 1955-57 practically the whole coastline of the State was explored by various mining companies and other interests, and productive operations came into being in the Noosa area.

In conjunction with this major surge of exploration it seemed desirable that this Survey should undertake a study of the environment and distribution of heavy mineral concentrations in the coastal sand deposits and an overall review of possible total economic resources. The following report is the result of this work, which was commenced at the height of the boom in June 1956. As part of the work, detailed mapping of the coastal plain between Coolangatta and Fraser Island was completed and is reproduced on the accompanying maps.

HISTORY OF BEACH SAND MINING IN QUEENSLAND

The black sands on the beaches between Southport (Q.) and Yamba (N.S.W.) first attracted attention between eighty and ninety years ago, and intermittent attempts were made to work them, first for their small gold content and later also for small proportions of tin and platinum. These endeavours, using amalgamated plates and sluice boxes, proved uneconomic and were soon abandoned (Rands 1889; Ball 1905).

The sands in this State received little further notice until 1928, when Beach Sand Mining Co. Ltd. was formed to exploit black sands at Tugun for gold, tin and zircon by means of concentrating on a Wilfley table, a tribute being later let to Ashworth Concentrating Syndicate. A second company, Black Lead Mineral Co. Inc., also operated for a time at Tugun. Results were unsatisfactory and activities lasted only a few years.

The modern beach sand mining industry in Eastern Australia was humbly born at Byron Bay (N.S.W.) in 1933, primarily as a source of industrial

zircon. As a result of war-time demand for rutile it developed rapidly into a major world source of both minerals, with rutile by far the more valuable. Early activities in Queensland were described by Carlson (1944, 1948, 1950), and only brief mention is included here. The industry in this State began with selective hand mining of rich beach seams at Burleigh Heads in 1941 by Mineral Deposits Syndicate—M.D.S. (succeeded in 1955 by Mineral Deposits Pty. Ltd.—M.D.P.), at Palm Beach–Bilinga in 1942 by Rutile Sands Pty.—R.S.P. (Rutile Sands Ltd.—R.S.L.—from 1957), and at Broadbeach in 1944 by Southport Minerals, succeeded in 1947 by Associated Minerals Pty. Ltd.—A.M.P.—(reconstructed in 1956 as Associated Minerals Consolidated Ltd.—A.M.C.).

It was not long before horse scoops, bull-dozers and other forms of mechanization were introduced. A small field tabling plant was also operated for a time at Flat Rock Creek, Tugun, by Mineral Deposits Syndicate.

By 1945, buried rich seams beneath the dunes at Broadbeach had been discovered and were being exploited on a large block of Crown land and on still vacant private allotments. (Subsequently, during the boom, much of this area was re-worked *in toto*.) Beach mining also extended northwards from Broadbeach to The Spit.

Initially the black sand was simply fed to Wilfley tables and the mixed concentrate bagged for shipment to the U.S.A. In the mid-40's however, prohibition of export in this form led to addition of electromagnetic and electrostatic separating units to the plants established at Southport (M.D.S. and A.M.P.) and Currumbin (R.S.P.). By the end of 1947 production of rutile and zircon as separate high-grade concentrates was standard practice at all works. (Carlson 1948, 1950.)

By this time The Zinc Corporation Ltd. had also become interested in beach sand deposits, and important discoveries by them on North Stradbroke Island led, in 1950, to productive operations by a newly-formed subsidiary, Titanium and Zirconium Industries Pty. Ltd. (TAZI). A separation plant was installed at Dunwich on the west coast, and a dredge and spiral concentrators operated initially on a low inland area (the "Back Run") north of the Eighteen Mile Swamp. Later (1952) this area was abandoned in favour of selective hand-mining of seams along the beach, which subsequently, in 1956, gave place to continuous working of dune areas behind the beach by means of dredge-mounted spirals. Two such units are now operating, in addition to a small dredge and portable spirals. An endless-rope bucket conveyor with rated capacity of 30 tons per hour was built in 1955 to carry the concentrate seven miles across the island to the Dunwich works.

A stationary spiral plant was likewise erected on South Stradbroke Island by A.M.P. in 1951 and operated for some time to reduce the bulk of sand transported from the beach there to their works at Southport. In 1951 the dredge pond and portable spirals method was adopted by M.D.S. to work *in toto* dune areas at Broadbeach and Burleigh.

In 1951 extensive exploration for new deposits began in "back" areas of the South Coast, resulting later in exploitation of such areas between Coolangatta and Tugun and near Burleigh. It may be recorded in passing that the coastal plain behind Bilinga had in 1945 been test-bored to bedrock by Alluvial Mining Equipment Ltd. as a large-scale dredging proposition. The flats north of Labrador, too, were scout-bored by the same company and again in 1947 by Alluvial Prospectors Ltd. Their primary interest being gold, operations were suspended when insignificant values of the precious metal were found.

During the years 1947-54 interest extended to other areas between South Stradbroke and Fraser Islands. The Geological Survey of Queensland conducted a reconnaissance of beach deposits in 1947 (Connah, Morton 1948). Brief reconnaissances were made of beaches further north by Zinc Corporation Ltd. and Dowsett Engineering (Aust.) Pty. Ltd. In 1952 Titanium Alloy Manufacturing Co. Pty. Ltd. (TAMCO) entered the prospecting field in this State near Double Island Point and their subsequent work was concentrated upon "back" areas of potential importance on the Inskip Peninsula and Fraser Island.

Between 1955 and 1957 virtually the whole coastline of the State was combed by numerous interests, and as a result many areas were pegged south from Sandy Cape. Results further north were, on the whole, disappointing, but deposits of prospective value came to light near Bundaberg, Gladstone and, possibly, Mackay. Titanium Corporation of Australia Pty. Ltd. (TCA) erected a separation plant near Tewantin and in 1956 became the first commercial producer of rutile from the high-ilmenite sands of northern beaches.

On Moreton Island, first investigated by the Zinc Corporation Ltd. in 1947 and later by other interests, Zircon Rutile Ltd. and Whale Products Pty. Ltd. became associated in extensive exploration in 1955, and Tangalooma Minerals Pty. Ltd. was formed in 1956 as the operating company. A separation plant erected at Tangalooma Point was in production during 1957-58 from sand stockpiled from selective mining of eastern beach leases. This was not far from the site of tabling and magnetic plant installed in 1949 by Moreton Island Minerals Pty. Ltd. in connection with reconnaissance investigations.

During the rutile boom a separation plant built by Australasian Oil Exploration Ltd. at Mermaid Beach operated for eight months in 1957 on sand from leases at Tugun and in New South Wales. A small plant set up at Noosaville by East Coast Minerals Pty. Ltd. treated sand from the Noosa area in the same year. Rough mixed concentrate was also produced and trucked to established separation plants by Pacific Minerals (A. Neumann and Casey)—Currumbin and Bilinga beaches, from 1950; J. A. & L. Foyster—back area, Bilinga, 1956-57; Rutile

Mining Development Ltd.—Coolangatta 1957; and Rutile Corporation of Australia Ltd.—Miami, 1957-59.

The principal mineral products sold have been rutile and zircon. One company has separated and sold small quantities of clean garnet concentrate. From time to time monazite has been extracted as high-grade concentrate, and at one stage the Commonwealth Government purchased monazite-bearing concentrate as a possible source of thorium for nuclear energy production; but much of the small content of this mineral has gone into stockpile in the form of rejects which contain also stained zircon, garnet and accessory minerals. Except for a few small shipments, all the ilmenite concentrate has been stockpiled or dumped, as it has been unsaleable without further treatment to eliminate a small proportion of chromite.

PREVIOUS INVESTIGATIONS

Black sand deposits in the Southport-Coolangatta area were referred to by Rands (1889) and dealt with at greater length by Ball (1905) in connection with attempts to work them for gold and tin. In the latter report zircon is recorded as a constituent.

Though the presence of rutile in the black sands of Northern New South Wales was known by 1925 (Raggatt, 1925)—and may have been inferred in the Southport–Coolangatta sands—the earliest known record of its occurrence in beach sands in Queensland is a report by Mr. F. E. Connah of the Government Analyst's Department on ten samples from the Main Beach between Jubilee Bridge and Lands End, submitted to the Geological Survey by the Mayor of Southport in September, 1928. The heavy mineral concentrate from the samples was "separated into a magnetic portion (largely titaniferous iron ore) and a non-magnetic complex comparatively free from iron in which rutile and zircon predominated." The report continued, rather prophetically, "The question of values in the sands depends on the economic separation of the rutile and zircon in the non-magnetic portion, a problem which seems likely to present considerable difficulty."

Shortly after the commencement of modern exploitation of the black sands, a study of the nature, distribution and origin of deposits between Coolangatta and Caloundra was made in 1945-46 by Beasley (Beasley, 1947 and 1949).

A reconnaissance of beaches from Southport to Fraser Island was carried out by the Geological Survey in 1947 (Connah, 1948; Morton, 1948), up to which time interest centred in richer seams, for selective mining, under shallow overburden on beaches and in adjacent dunes.

Extensive test-boring was carried out on North Stradbroke Island in 1947-48 by The Zinc Corporation Ltd. (Donaldson and Stuart, 1948) and later by its subsidiary, Titanium and Zirconium Industries Pty. Ltd.

During 1948-50 the Bureau of Mineral Resources conducted detailed investigations and sampling of beaches and dunes south from Southport (Gardner, 1955). Gardner contributed a detailed discussion of the origin of the deposits and their geological range and relationship to recent eustatic changes of sea level.

Subsequent exploration, by various interests, both for new inland deposits on the South Coast and of virtually the whole coastline of the State, has added greatly to our knowledge of heavy mineral occurrence along the coastal strip.

Recently, Whitworth (1959) has made a valuable detailed study of the mineral composition and origin of the heavy minerals in the coastal sands of New South Wales and Southern Queensland. He concluded, from convincing evidence, that most of the rutile and much of the zircon originated in the Pre-cambrian Shield, and that these two would be the dominant minerals in a natural end product of erosion anywhere in Australia; where the suite does not consist mainly of these two minerals, either the end product has not been reached or there has been a recent addition from local sources.

HEAVY MINERAL CONCENTRATION

Four types of significant heavy mineral concentration have been recognised.

(1) *By storm-wave action at the top of a beach.*—This, in conjunction with a prevailing northerly drift, has undoubtedly been the agency by which the most common type of deposit has been formed. Such deposits occur on present beaches and on buried former strand lines behind them. Their size, grade and value naturally depend upon the efficiency of the forces at work, upon the duration of the period of build-up, upon the available supply of heavy mineral, and upon the composition of the heavy minerals.

The process has been described in detail elsewhere (Beasley, 1947; Gardner, 1955; Whitworth, 1959). The principal agencies necessary are a wave-force sufficient to carry the heavy minerals up the beach beyond normal high-water mark; sufficient energy in the returning water to carry much or all of the light sand but leave the black sand behind; and a suitable slope on the beach to assist these.

Concentrations occur periodically during storms which develop the requisite conditions. They do not, however, survive for long unless there is an immediate build-up of a protective cover of sand. They may become contaminated with wind-blown white sand, partially destroyed by wave action, or blown into the dunes.

All degrees of concentration are found, from single or repeated pencil streaks to seams of pure black sand up to 8 ft thick. The seams are wedge-shaped in cross section, commonly 30 to 80 ft wide, and of variable length. There may be two or more seams deposited successively and overlapping en echelon.

Given an adequate source of supply, the richest deposits occur on long beaches exposed to surf, especially in areas where there has been progressive re-working of concentrations. With a prevailing northerly drift due to south-east winds and inshore current concentrations are greatest at the northern end of a beach against a headland, river mouth or other natural barrier.

Beach concentrations are obviously governed by the supply of heavy mineral from the rivers, and this in turn depends upon the amount of sand transported by the rivers and on the heavy mineral contribution from the weathering rocks of the catchments. Although no studies have been made, it is believed that the occurrence of heavy mineral concentrations on the beaches can be related to varying climatic, physiographic and geological influences. Whitworth (1959) attributes the rich concentrations of northern New South Wales and Southern Queensland to the high incidence of cyclonic storms of both summer and winter type, causing periodic heavy flooding in swiftly flowing rivers and marked concentrating action on the sand thus delivered to the beaches in abnormally large quantities.

The rivers further north carry large volumes of sand when in flood but this happens normally for only brief periods during the summer wet season. The occurrence of rich concentrations of black sand in places along the tropical coast (e.g. Shoal Point, Mackay) indicates that wave concentration is sometimes just as efficient as on southern beaches, despite the protective influence of the Great Barrier Reef.

On beaches which have been previously worked regeneration may occur repeatedly, yielding valuable seasonal harvests. Where erosion of earlier beach deposits and dunes with their wind concentrations takes place this regeneration is at its greatest, and much of the rich seasonal washings on South Coast beaches is the result of such processes. On beaches subject to erosion, where beach and frontal dune have been worked (e.g. North Burleigh) it is found that the amount of fresh material deposited is very greatly reduced.

Storm-wave deposits occur at intervals along the whole coastline, the most important in size and mineral content being from Fraser Island southwards. Over the same sector they occur also in places on former strand lines now buried beneath dune sand, e.g. Broadbeach, Stradbroke Island and Inskip Peninsula. Concentrations of prospective value for their high content of low-chrome ilmenite in addition to rutile and zircon occur intermittently between Bundaberg and Cape Clinton, but further north sandy beaches are rarely developed on anything like the same scale and heavy mineral concentrations are much less frequent and generally of small size.

(2) By *wind-sorting* in dunes and to some extent on beaches and parts of the adjoining coastal plain. This type is commonly observed as thin films of black sand on the surface and in the truncated edges of dunes. The dune sand is, of course, derived from the beach by wind transport. Dune concentrations do not compare in grade with the wave-concentrations, but in areas of extensive dune development they can contribute important and superior quantities of heavy mineral, e.g. Stradbroke Island. Economically interesting concentrations may occur in both parallel and transgressive dunes (cf. Broadbeach and South Stradbroke Island), and do not necessarily bear any relation to concentrations on the adjoining present beach. Near Bustard Head concentrations occur in dunes, with little or none on the present beach.

A unique case is the high dunes of North Stradbroke Island which contain large low grade reserves of economic importance. Their formation must have required rather specialised conditions, with persistent winds strong enough to carry them up over the earlier dunes. Similar high dunes occur on Moreton Island and at Noosa, Double Island Point and Fraser Island, but they appear to contain practically no heavy mineral, presumably because of a lack of supply. Wind concentrations of prospective economic value occur also in well-developed dunes at several places between Bundaberg and Cape Clinton.

(3) *By interaction of tidal currents* in protected waters. A "pepper and salt" distribution of heavy minerals may apparently be produced in sand banks deposited by such means, an instance being on the south-west side of Moreton Island, where a large bank, exposed at low water, has formed at the meeting of tides from the northern and southern ends of the Bay. It is suspected that much of this sand is derived from the adjacent dunes of the Island, where recent prospecting showed some slight concentration; but the presence of 5 to 20% of magnetite in the heavy minerals indicates an addition from a local landward source.

It is believed that much of the low-grade material found in low-lying flats and swamps behind the beach at Bilinga was due to re-distribution by estuarine currents of previously formed beach concentrations.

(4) A different type of concentration—perhaps without parallel—is that at Urquhart Point, near Weipa, where heavy mineral occurs in a quite high-grade dune mass, without any cover or interbedding of low-grade sand, in a sheltered estuary protected from open-sea wave and storm action. The mechanism requisite for such a deposit is not apparent, but it obviously requires long-continued stable concentrating conditions, as opposed to the intermittent action on surf beaches. I am informed by H. J. Evans that concentration is in constant progress on the estuarine

beach adjoining the deposit, as the nett result of interaction between tidal currents and oblique waves resultant from ESE winds which persist through most of the year. Possibly the dune deposits are the result of constant accumulation by this means over a lengthy period of gradual recession of sea level.

PHYSIOGRAPHIC ENVIRONMENT AND LOCALISATION OF DEPOSITS

Sandy beaches occupy a large proportion of the Queensland coastline. They form stretches of widely varying length between rocky headlands, river mouths, straits and swampy fringes. South from Broadsound they have the typical arcuate shape resultant from inshore currents and longitudinal drift, which is best developed on the surf beaches south from Sandy Cape, and they are backed by dune belts of widely varying width and height. North from Broadsound, under the protective influence of the Barrier Reef, these features are not nearly so well developed and beach profiles are flat. On the north-eastern Peninsula dunes of barchan type are common, but there is no longitudinal drift. Much of the west coast of the Peninsula is low-lying, with minor dune formation in places.

South from Moreton Bay the coastal dunes include a series of parallel ridges clearly formed as successive foredunes during eastward migration of the strand in Recent times. This is the common type of dune topography of northern New South Wales. At Broadbeach at least twelve dune ridges were recognised in a width of ¼ mile.

Northwards, with the exception of Inskip Peninsula, no similar parallel systems are found, the coastal dunes being merely a narrow fringe formed by sand movement roughly in the direction of the prevailing wind, and called by Gardner transgressive dunes.

The coastal plain is composed principally of sand and estuarine silty alluvium, and its western margin is a well-marked scarp, clearly the strand line prior to the last major emergence. Only isolated dune remnants exist along this line, the sole one of any significance being at Elanora. Within the coastal plain, too, sand ridges marking the positions of former beach lines are known only south from Caloundra, e.g. North Burleigh, behind Mermaid Beach, Coombabah and Bribie Island. It would appear that these ridges have developed as sand spits and that eastward migration of the shore took place not as a steady progression but as a series of stages of spit growth possibly accompanied by small emergence, with development of lagoons in which swampy sandrock and sometimes peat was formed. Between these dunes on Bribie Island and at Coombabah, are wide low sandy tracts with a pattern of longitudinal slight ridges. Very little heavy mineral has been found along these ridges, and it is believed that they represent not old dune lines, but raised off-shore banks. North from Caloundra, the occurrence of sand-rock on the beaches below high-water level indicates that the shoreline was formerly further east and that there has been a recent small submergence.

Along the South Queensland coast there are several large sand masses which are believed to date back to Pleistocene times (Coaldrake 1960). These giant dune masses are separated from the mainland by straits and bays or raised marine corridors characterized by lakes; and it is to this protection from mainland drainage that they owe their preservation. North Stradbroke and Moreton Islands, the Cooloola mass east of the Noosa River valley, and the main mass of Fraser Island are tied to rocky headlands at their north-eastern extremities. They consist of high transgressive dunes which attain heights of several hundred feet, culminating in Mt. Tempest on Moreton Island, 924 ft. The eastern edge of these dunes is a prominent scarp. On North Stradbroke and Southern Fraser Islands a small emergence has created a newer belt of coastal dunes separated from the main mass by swampy lowland. There is a smaller dune mass of similar type just south of Noosa Head. At Cape Clinton north of Rockhampton dunes up to 150 ft high are recorded, and possibly date back to the Pleistocene.

The giant dunes of Southern Queensland contain enormous quantities of sand, in which heavy mineral values of economic interest have been located only on North Stradbroke Island. These, though of very low grade, are of major importance because of their size.

Apart from the beaches and coastal dunes which are obvious areas for likely heavy mineral concentrations, extensive prospecting between Coolangatta and Southport has indicated that concentrations of commercial interest within the coastal plain are localised in areas where there are evidences of former stable strand-lines, i.e. the old sand spits and dunes. Open-spaced boring over much of the remainder of the plain has revealed only trace values, and although it is conceivable that such boring could have missed small richer deposits, the prospect of significant undiscovered commercial concentrations seems slight. In addition, the limited amount of deeper boring in coastal dune and swamp areas has revealed, with a few minor exceptions, only traces of heavy mineral in the sand below present low-water level. In the face of this evidence, the wide featureless low plains behind the beaches further north, commonly with a shallow layer of hard sand rock, appear to offer very little prospect of commercially attractive concentrations.

HEAVY MINERALS IN THE SEA BED

There seems to be a popular conception that the heavy minerals are derived from the sea bed, and the possibility of workable concentrations therein has been considered. It should be remembered, however, that all the sand, including the heavy minerals, was brought down by the rivers which deposit their burden at the bar, thence to be dispersed by ocean currents and transported to the beaches by wave action. It is obvious that the sand of the surf zone must act as a reservoir of heavy minerals—albeit a very low-grade one. But it is extremely unlikely that heavy minerals could be carried seawards for any distance beyond the bar, and even if they were, that there could be any effective submarine concentration. If they do occur in any appreciable proportion in the present sea bed beyond the surf zone it must be by reason of submergence of a former strandline without progressive breaking up and migration of all black sand with the shore—a process which might be accomplished only by sudden changes such as faulting.

It appears much more likely that most of the heavy mineral migrates with the strand-line except when concentrations become preserved to landward of it by sand-cover, by eastward migration of the shore, and/or by a fall of sea level (e.g. the buried rich seams of Broadbeach and Bureligh). In other words, with a static or falling sea-level heavy mineral concentrations can be preserved at elevations at or above that of current deposition, but with rising sea level they will break up and migrate with the shore. If this be the case, then preservation of concentrations below present low-water level is improbable except to landward of a buffer zone of dunes.

Beasley (1947, footnote p. 134) reported finding black sand on a bank ¼ mile off Palm Beach and there are unconfirmed reports of heavy black sand being scooped from the off-shore sea-bed by fishermen; but in neither case is its thickness known. Recent testing off Southport and Noosa could be carried to only shallow depth (maximum 15 ft) and in the few bores sunk it failed to reveal any appreciable content of heavy minerals.

Certain it is that with present means adequate prospecting of the sea-bed off surf beaches would be an extremely difficult task, and its economic working almost impossible unless for a rich reward.

MINERALOGICAL COMPOSITION

The beach sand deposits consist of a complex of heavy minerals mixed with white quartz sand in any proportions. The mineralogy of the heavy mineral concentrates of Southern Queensland has been described in detail by Beasley (1947) and by Whitworth (1932, 1959). The minor minerals of northern deposits have not been studied in similar detail. The brief notes which follow summarize the principal mineralogical features.

The deposits south from Moreton Bay are outstanding for the high proportions of rutile and zircon in the "heavies," which are composed principally of these two minerals and ilmenite. Northwards to Fraser Island ilmenite predominates, but rutile and zircon are still important constituents. Further north again, rutile and zircon decline still further, with a local small increase near Rockhampton, and magnetite appears as an almost constant associate of ilmenite, reaching quite a large proportion between Mackay and Townsville. The heavy minerals on Peninsula beaches are of variable composition, but are frequently marked by high proportions of rutile and zircon.

Small variations in rutile : zircon : ilmente proportions have been noted along and across some deposits worked on the South Coast. Gardner (1955) made detailed measurements of such variations between Southport and Cape Byron. They appear to reflect the slightly easier transportation, because of somewhat lower density, of ilmenite and rutile relative to zircon.

On South Coast beaches leucoxene, garnet and chromite are invariably present in small proportion, as well as traces of cassiterite. Minor constituents of fairly general occurrence include monazite and more resistant silicates and oxides such as tourmaline, hornblende, staurolite and spinel. Gold and platinum have been recorded in traces at Currumbin. Some monazite and garnet have been recovered as high-grade products at separation plants in the South.

Ilmenite fractions separated electromagnetically at existing plants contain a small percentage of chromic oxide. Investigations by the C.S.I.R.O. Mineragraphic Branch (Stillwell and Baker 1948) have shown that most of this is present as distinct grains of chromium-bearing minerals—principally chromite and occasionally picotite—and that by refined magnetic separation part of the ilmenite can be recovered as a low-chrome product. Laboratory ilmenite fractions from black sands of northern beaches show lower chromic oxide content, which at Mackay is as little as 0·02 to 0·03%. The excessive chrome content renders the ilmenite fractions separated at existing plants unsaleable for pigment manufacture.

Methods of identification of the various minerals and of determining their proportions in samples have been excellently described in detail by Whitworth (1959). Briefly, the standard quantitative procedure is (1) dish concentration to remove most of the worthless light minerals (occasionally bromoform sink-float separation is adopted); (2) withdrawal of any magnetite with a hand permanent magnet; (3) electromagnetic separation of a high-ilmenite fraction which is checked by microscope grain count; and (4) estimation of proportions of the remaining heavy minerals

either by grain count (the procedure used at the Geological Survey of Queensland) or by small-scale electro-static separation (adopted by some companies). Whitworth describes a useful rapid method which he devised for sands of rutile-zircon predominance, based on comparison of the colour of the sand with standard mixtures of known rutile-zircon proportions.

The following tables summarise available mineralogical data:—

AVERAGE COMPOSITION, HEAVY MINERALS

Locality	Zircon	Rutile	Ilmenite	Magnetite	Monazite
	%	%	%	%	%
Tugun	42	32	25	..	0·5
Tugun–Bilinga back area	25–45	25–35	25–50	..	not available
Palm Beach	41	36	23	..	0·5
Burleigh Heads—beach and foreshore	47	31	21	..	1·1
Miami dunes	38	36	25	..	not available
Mermaid Beach	41	36	23	..	0·7
Southport—The Spit	38	37	24	..	0·6
South Stradbroke Island—beach	34	35	30	..	0·5
South Stradbroke Island—dunes	28	34	33	..	not available
North Stradbroke Island—beach	31	37	31	..	0·2
North Stradbroke Island—coastal dunes	31	38	26	..	0·2
North Stradbroke Island " back run " area	14	22	58	..	not available
North Stradbroke Island high dunes	17	28	51	..	0·12
North Stradbroke Island northern beach	17	14	60	7	not available
Moreton Island—ocean beach	23	19	56	..	0·9
Moreton Island—western beach	10	10	80	..	..
Bribie Island beach	22	18	58	..	1·1
Coolum—Noosa beach	19	18	61	..	0·7
Laguna beach	21	19	58	..	0·7
Inskip Peninsula beach	21	15	62	..	1·0
Inskip Peninsula dunes	17	17	63	..	0·45
Fraser Island–Indian Head—berm	21	19	57	..	0·5
Fraser Island–Waddy Point–Sandy Cape—dunes	24	16	60	..	not determined
Coonarr Creek (Laycock's)	13	10	75	..	not determined
Round Hill Head dunes	4	4	91	..	not determined
Bustard Head beach and dunes	6	1·5	92	..	not determined
Facing Island beach	8	1	87	..	not determined
Curtis Island (Yellow Patch) dunes	13	9	76	..	not determined
Cape Clinton beach and dunes	14	8	77	..	not determined
Clairview–Carmila—beach	18	3·5	not determined	not determined	not determined
Mackay–Shoal Point—beach	7	trace	40	52	not determined
Bowen—beaches	trace	..	83	16	not determined
*Alva, near Ayr	5	0·3	69	23	not determined
Hinchinbrook Island (Ramsay Bay)—beach and dune	9	2	58	6	not determined
Cape Grafton (Oombunghi Beach)	20	3	75	(magnetics)	not determined
*Princess Charlotte Bay	1	1	62	2	not determined
*Shelburne Bay	30	53	2	..	not determined
Urquhart Point (Weipa)	28	25	Small	not available	not determined
*Prince of Wales Island	65	trace	24	5	not determined
*Mornington Island	15	3	72	8	not determined

* Random samples

ANALYSES OF CLEANED MONAZITE CONCENTRATE FROM BEACH SANDS

Locality	ThO_2	Ce_2O_3	Rare earth oxides	Sulphuric acid Insolubles
	%	%	%	%
Tugun	7·1	27·7	32·5	0·4
Little Burleigh	6·2	28·5	33·1	1·2
Broadbeach	6·4	25·9	29·6	9·3
North Stradbroke Island	5·9	25·6	32·7	7·6
Inskip Point (beach) (90% concentrate)	6·4	27·3	35·5	5·8

ANALYSES OF ILMENITE FRACTIONS FROM BEACH SANDS

Locality	TiO_2	FeO	Fe_2O_3	Cr_2O_3
	%	%	%	%
Tugun	48·0	32·0	10·3	5·1
Little Burleigh	48·0	32·0	10·1	5·2
M.D.P. 100 tons, 1957	46·9	..	†39·56	4·73
South Stradbroke Island	47·8	30·6	11·4	1·9
North Stradbroke Island (beach)	50·0	31·5	11·8	0·9
Moreton Island—east coast	..	..	..	0·2
*Moreton Island—west coast	51·0	29·9	..	0·48
Point Arkwright	50·0	31·5	11·8	1·0
Noosa Beach	50·0	31·5	11·8	0·5
Double Island Point	50·0	31·0	11·5	1·2
Inskip Point	52·6	33·5	10·5	0·9
Indian Head (Fraser Island)	50·0	31·0	11·4	1·3
Round Hill Head	50·01	..	..	0·11
Curtis Island northern beach	..	..	..	0·12
Cape Clinton	46·3	..	..	0·25
Shoal Point (Mackay)	46·6	30·1	18·0	0·02
*Townsville (Kissing Point)	..	..	..	0·01
*Cardwell	..	..	..	0·23

* Random samples. † Total iron.

ORIGIN OF THE HEAVY MINERALS

The question of the origin of the beach sand heavy minerals of central eastern Australia has been studied by Beasley (1948), Gardner (1955) and Whitworth (1959), and little can be added here. Whitworth has concluded from detailed investigations that a simple zircon-rutile suite is the natural end-product of long-continued erosion, and he explains the wide distribution of detrital zircon and rutile in Australia as due largely to ultimate derivation from pegmatite and quartz veins in the pre-Cambrian shield. He emphasised that the occurrence of zircon and rutile of closely similar type and grain size over 700 miles of coastline south from Fraser Island indicated derivation from no one localised source. The argument is now strengthened by the addition of further coastline at least as far north as Cape Clinton.

Whitworth thus regards beach sand concentrations as essentially mixtures of zircon and rutile with adventitious admixtures of ilmenite and magnetite from local sources.

The immediate source of the heavy minerals has been indicated by their recognition in Mesozoic and Permian sediments of the Sydney, Clarence and Moreton Basins. It is generally agreed that the sands from Fraser Island southwards are derived principally from these sources. No similar studies have been made of northern areas, but it must be obvious to the most casual observer that all the major river systems from the Mary northwards bring down considerable volumes of sand, and that the heavy minerals on these beaches are derived from break-down of rocks within those catchments. The ilmenite and magnetite may reasonably be expected to derive from local igneous rocks, especially basic types. The small proportions of rutile and zircon in the heavy minerals of Central Queensland sands suggest a paucity of these detrital minerals in the vast areas of sedimentary rocks of the hinterland. The variability in heavy mineral composition in the Peninsula sands is a reflection of the lack of longitudinal drift. The ultimate origin of their zircon and rutile is perhaps the large pre-Cambrian areas of the Divide there.

MINING AND SEPARATION

Methods of mining of the black sand deposits have been excellently described by Carlson (1944, 1948, 1950) and Bayly (1952), and in an editorial survey in Chemical Engineering and Mining Review (June 1955). The separation of the saleable products has been discussed by Carlson and Bayly and later in detail by Blaskett (1950), Dunkin (1953) and Hudson and Blaskett (1958). Mining and separation methods were concisely summarised recently by Whitworth (1959). Only very brief reference is made here.

Rich beach seams are worked selectively by hand or mechanical shovelling, and trucked direct to the separation plant. Lower grade deposits in dune and back areas are now worked by suction dredge and spiral-concentrated in from one to three stages before despatch to the plant. Here the treatment process involves tabling, drying and high-tension electrostatic and electromagnetic units, adapted in various flow-sheets according to the mineral composition of the sand and to results obtained in laboratory or pilot plants, or from experience gained by established companies. Specifications for the grade of saleable products are stringent and call for close control at all stages. Rutile now produced is from 96 to 99% pure (95–97 TiO_2) and zircon generally 99%+ (65–66% ZrO_2).

Small quantities of garnet and monazite have been separated for sale as high grade products by extension of the same methods but much of the small content of these minerals in the sand at present finds its way to stockpiled magnetic products which contain also appreciable iron-stained zircon and some rutile.

Most of the ilmenite fraction from the separation plants has been stockpiled or dumped, as it is unsaleable because of a small content of chromite and/or picotite. Unless there is a radical change in the price structure, there is no prospect of this product from plants operating in Southern Queensland being re-treated to produce a marketable ilmenite.

TABLE OF PRODUCTION

Saleable Beach Sand Products—Queensland

Year	Source	Zircon Concentrate[5] Tons		Rutile Concentrate[6] Tons		Monazite Concentrate[7] Tons	Monazite Est. M (tons)		Mixed Concentrate Tons	Mixed Z/R/I	Zircon-Rutile Concentrate Tons	Zircon-Rutile Z/R	Estimated Value all Saleable Products £A
1941	Burleigh[1]	..	..	..	..	..	..		1,000	45/25/25	..	..	7,558
1942	Burleigh[1]	..	..	..	..	0·5			3,634		..	..	31,373
1943	Broadbeach, Burleigh and Tugun (South Coast) — selective mining of dunes and beach	..	..	..	..	1·7			7,969		..		65,029
1944		..	..	..	..	..			12,528		1,634		123,955
1945		268		156		..			9,219	42/32/26	3,771	48/47	126,020
1946		2,296		1,665		..			1,304	42/32/26	4,237	48/47	127,476
1947		3,943		2,966		..				..	3,345		152,889
									Garnet Conc.[7] Tons		Ilmenite Conc.[7] Tons		
1948		7,080		6,071		300		45		18		52	226,687
1949		5,850		5,074		121		21		35		40	177,155
1950	South Coast[2]	6,292		7,136		10			..	..	200		
	North Stradbroke Island[3] ..	484		593		..			..		..		
			6,776		7,729		10	9		..		200	251,250
1951	South Coast[2]	7,400		9,741		10·5			3		10·5		
	North Stradbroke Island[3] ..	1,492		1,769		..			..		10		
			8,892		11,510		10·5	10		3		20·5	391,319
1952	South Coast[3] and South Stradbroke Island[1]	9,032		11,174		2·7			48		..		
	North Stradbroke Island[1] ..	1,507		2,390		..			..		15		
			10,539		13,564		2·7	2·5		48		15	652,678
1953	South Coast[3]	8,595		11,300		55			35		..		
	North Stradbroke Island[1] ..	3,084		4,824		25			..		100		
			11,679		16,124		80	74		35		100	970,433
1954	South Coast[3]	9,111		12,894		9·1			..		..		
	North Stradbroke Island[1] ..	3,605		6,515		..			..		5		
			12,716		19,409		9·1	9		..		5	892,196
1955	South Coast[4] and South Stradbroke Island[1]	11,082		15,854		5			..		..		
	North Stradbroke Island[1] ..	3,078		5,471		42			..		65		
			14,160		21,325		47	45		..		65	1,155,358
1956	South Coast[4] and South Stradbroke Island[1]	13,013		15,359		6			..		..		
	North Stradbroke Island[3] ..	5,178		9,290		..			..		..		
	Noosa[1]	781		1,585		..			..		..		
			18,972		26,234		6	6		..		..	1,861,990
1957	South Coast[4] and South Stradbroke Island[1]	8,615		14,959		13·25			..		150		
	North Stradbroke Island[3] ..	7,175		11,837		67·7			..		..		
	Moreton Island[1]	2,125		1,991		..			..		..		
	Noosa[1]	4,753		3,056		..			..		..		
			22,668		31,843		80·95	78		..		150	2,479,664
1958	South Coast[4] and South Stradbroke Island[1]	2,567		4,816		..			36†		150		
	North Stradbroke Island[3] ..	9,200		15,687		54·6			..		..		
	Moreton Island[1]	1,135		1,008		..			..		..		
	Noosa[1]	2,513		1,477		61·1			..		..		
			15,415		22,988		115·7	111		36		150	1,761,266
1959	South Coast[4] and South Stradbroke Island[1]	3,983		3,762		30†			48†		25†		
	North Stradbroke Island[3] ..	8,747		14,816		24·85			..		..		
	Noosa[1]	2,395		1,154		30·5			..		..		
			15,125		19,732		85·35	82		48		25	1,376,017
1960	South Coast[4] and South Stradbroke Island[1]	5,065		2,579		41†			97†		76†		
	North Stradbroke Island[3] ..	8,194		13,535		60·18			..		22		
	Noosa[1]	1,887		916		15·18			..		..		
			15,146		17,030		*116·36	110		*97		98	1,160,861

[1] Selective mining of beach. [2] Selective mining of dunes and beach. [3] Dredging of dune areas, and beach scrapings. [4] Dredging of dune and " back " areas, and seasonal beach scrapings. [5] Product 1945–48 85–95% Zircon ; 1949 onwards 99% Zircon. [6] Product 1945–49 94–95% Rutile ; 1950 onwards 96–97% Rutile. [7] Sales reported.
† Includes an undifferentiated amount from New South Wales sources. * Production to this date includes also the following stocks on hand :—Monazite Concentrate 224 tons, Garnet Concentrate 66 tons.

RESERVES

The following tabulation summarises estimated reserves in the principal areas in round figures. It is probable that more detailed testing would increase reserves in some areas. The Coolangatta-Southport district is not included because remaining available reserves, in low grade deposits at Kirra, Elanora, The Spit (Southport) and Coombabah, are small. Beach leases can be expected to continue to yield a few thousand tons of heavy mineral per annum for a few more years.

Other beach deposits south from Double Island Point have been largely depleted, but limited quantities will still become available periodically by regeneration and from remaining unworked sections of the coast. Beach deposits further north are high in ilmenite, and with few exceptions do not appear of sufficient size individually to form the basis of an industry. Thus beach resources generally must now be regarded rather as a useful adjunct to established mining in neighbouring areas.

RESERVES OF BEACH SAND HEAVY MINERALS

Locality	Grade H.M.	Total Heavy Mineral	Zircon	Rutile	Ilmenite	Monazite	Remarks
	%	Tons	Tons	Tons	Tons	Tons	
SOUTH STRADBROKE ISLAND—							
Beach	medium	35,000	12,000	12,000	10,500	175	Estimate J. H. Reid 1949, less sand mined
Dunes	1·2	135,000	37,500	45,000	44,000	..	Measured and indicated (A.M.C.)
NORTH STRADBROKE ISLAND—							
Beach	high	small	..	..	..	..	..
Coastal Dunes—S M L 931	low	370,000	90,000	140,000	110,000	500	Estimate based on results of mining to date
D L 146	low	40,000	17,000	13,000	..	..	Measured and indicated (A.O.E.)
"Back Run" S M L 931	low*	200,000+	30,000	45,000	120,000	250	*Possibly minable, but dune encroachment reducing grade
North Coast Dunes	4 to 8	Appreciable	..	high	ilmenite	..	..
Giant Dunes—							
S M L 931	0·7	10,500,000	1,750,000	3,000,000	5,500,000	12,000	Inferred (T.A.Z.I.)
South R 1362	4·8	30,000	5,500	4,800	18,000	90	Indicated (A.O.E.)—one ridge
MORETON ISLAND—							
Beach	high	20,000 ?	..	..	..	..	Inferred
Coastal Dunes—C. Cliff–Eager Creek	low	175,000	25,000	45,000	100,000	..	Indicated
BRIBIE ISLAND—							
Beach—northern end	10–15	25,000	5,000	6,000	13,000	..	Indicated and inferred
Inland Ridge		Possibly substantial — quantity and grade not positively assessed					
CALOUNDRA–NOOSA—							
Currimundi Creek north—beach	..	2,800	600	500	1,400	..	Indicated (A.O.E.)—transient deposits
Point Arkwright south—beach	..	4,700	1,000	900	2,600	..	
Coolum–Paradise Caves—beach	..	5,300	1,000	900	3,200	50	
NOOSA–DOUBLE ISLAND POINT—							
Beach	..	20,000 ?	..	..	..	..	Inferred—transient deposits
Dunes	..	small	..	..	..	..	..
INSKIP PENINSULA—							
Beach (east)	high	20,000	4,000	3,400	12,000	200	Indicated (G.S.Q. 1948)—Transient deposits
Inland dunes	low	420,000	70,000	71,000	263,000	1,800	Indicated (TAMCO)
Strait berm	medium	68,000	17,000	10,000	39,000	300	Indicated (TAMCO)
FRASER ISLAND—							
North Spit—coastal dunes and berm	very low	300,000	43,000	50,000	200,000	1,000	Indicated (TAMCO)
Indian Head south—berm	low	185,000	39,000	35,000	105,000	900	Indicated (TAMCO)
Waddy Point–Sandy Cape—dunes and berm	low	95,000	23,000	15,000	57,000	400	Indicated (TAMCO)
Beach (east)	..	Periodic storm concentrations				..	Transient
COONARR CREEK (beach and berm)	..	8,000	1,000	800	6,000	..	Estimate J. O. Cuthbert
ROUND HILL HEAD AREA (Miriam Vale)—dunes	low	980,000	40,000	26,000	903,000	..	Three separate areas. Estimated total (MDP)
CURTIS ISLAND—							
Beach	about 15	49,000	9,000	2,000	36,000	..	Estimated Cardno and Davies (1957)—Transient deposits
"Yellow Patch" dunes		Probably substantial — quantity and grade not assessed, but about 3% to 30 ft.					
Northern Sandy fringe		Possibly appreciable — quantity and grade not assessed					
WATERPARK POINT–							
CAPE CLINTON—Beaches	4 to 50	235,000	32,000	18,000	181,000	..	Five separate areas. Estimated total (MDP)
MACKAY—							
Beach, Shoal Point	50	10,000	700	..	4,000	..	Indicated. Transient
HINCHINBROOK ISLAND—							
Beach, Ramsay Bay		Transient small black sand deposits, low in rutile and zircon					
PENINSULA–URQUHART POINT	9·5	32,000	10,000	8,000	small	..	Based on estimate A. M. and S. Co.

Very low = 1–3% Low = 3–10% Medium = 10–30%

An overwhelming proportion of the large total reserves of present economic interest lies in coastal dune areas of low to moderate grade south from Sandy Cape. There are still greater resources in the old dunes of North Stradbroke Island at a grade below present working limits.

The stockpiles and dumps of ilmenite concentrate at existing plants are estimated to aggregate upwards of 150,000 tons containing at least 80% ilmenite, and are a potential source of that mineral if its further refining should become economically practicable.

FUTURE OUTLOOK

The past fortunes of the beach sand mining industry have been related to war-time demand for rutile and to the rapid development of the metallic titanium industry in U.S.A. and Europe in 1954. However, the anticipated large-scale utilization of titanium metal in the aircraft industry did not materialize, and by the end of 1957, because of restriction in military aircraft construction and accumulation of stockpiled rutile in the U.S.A., the rutile market had again slumped. Forward contracts for rutile at now high prices have maintained established operators in production, though on a reduced scale.

Nevertheless, industrial use of rutile in welding rod coatings continues, and it can scarcely be doubted that other peaceful uses for titanium metal, e.g. as alloys, will gradually develop, although no marked expansion is likely without reduction in its cost. Rutile is already being considered as an alternative source of titanium white, and it is claimed that at £45 per ton it could compete with ilmenite in this sphere. The zircon market has recently shown signs of improving. Establishment of firm markets for both rutile and zircon, at steady price levels, would bring to the beach sand industry a degree of stability previously unknown.

With available deposits on the Gold Coast nearing exhaustion, future production must be looked for principally from the low dune lands of the large sandy islands and the Inskip Peninsula, whose total proved and prospective reserves are large. Further appreciable reserves of high-ilmenite sand occur in dunes at a few places in Central Queensland.

By far the largest heavy mineral reserves are contained in the high dunes of North Stradbroke Island, for which, however, an economic method of mining has yet to be evolved.

The industry is a potential source of appreciably larger monazite production if a market at a worthwhile price were assured. Possible means of improving monazite recovery at existing plants were considered in detail by Hudson and Blaskett (1958).

An increased demand, too, for ilmenite would surely direct renewed attention to some northern areas, where there are in the aggregate substantial quantities of high-ilmenite sand low in chrome. There is, however, no one known area containing sufficient reserves to be attractive for development under present conditions as a commercial source of ilmenite alone. Metallurgical research is needed on the economic separation of the minerals in these high-ilmenite sands.

Unless there is a radical change in the market structure, beach sand mining in Queensland will continue to be associated primarily with rutile and zircon production.

PART 2—DETAILS OF LOCAL AREAS

SOUTHERN QUEENSLAND

1. COOLANGATTA—SOUTHPORT

This strip is notable for its extensive high-grade deposits in both beach and dunes, which have yielded a large proportion of the State's output of rutile and zircon. Seasonal storm concentrations still yield periodic rich harvests, but they now contribute only a small proportion of total output. Available high-grade dune areas are virtually worked out, although large reserves remain, unavailable for mining, in improved areas between Bilinga and Surfers' Paradise. Since 1955 a large part of production has come from low-grade "back" areas, which on available information are nearing exhaustion on the northern side of the Border.

This coastal strip is closely related physiographically and mineralogically to the coastal sand areas of far northern New South Wales, of which it forms a natural extension. Topography and geological background have been described in detail by Beasley (1948) and Gardner (1955). In brief, coastal plains, from ½ mile to 3 miles wide, extend between headlands of lower Palaeozoic rocks with denuded thin cappings of Tertiary basalt. The coastal dune belt varies in width up to nearly ½ mile and consists of several ridges (up to twelve at Broadbeach) paralleling the coast. Between this belt and the western margin of the plain the country is generally flat and low-lying, but from it rise several sand ridges which are clearly remnants of old intermediate strand lines. Towards the northern end is the old wide flood plain of the Nerang River.

Coastal Dunes

Most of the available areas in the coastal dunes were worked to levels approximating low-water level, at which boring showed usually quite a sharp cut-off in grade. At Broadbeach the dunes were worked over distances up to 15 chains behind the beach, values further west becoming too poor. The buried seams were all correlatable to sea levels at or only slightly above present level. Gardner's low-level (– 5 ft.) deposits at Burleigh are on bedrock "highs" and may be unreliable indicators of associated sea levels. The rich seams originally worked selectively at Broadbeach were up to 7 to 8 ft. thick, and within 4 chains west from the beach 2 to 3 ft. sections carried 70% to 80% heavy mineral. Areas later worked *in toto* are reported to have averaged from 3% to over 10% heavy mineral over depths up to 20 ft, including rich seams. Several deeper bores in dune areas have penetrated up to 50 ft. or more of similar quartz sand (Beasley 1948) but they have located no concentrations of economic interest below low water level. In any case, because of surface improvements these areas are rapidly becoming unavailable.

On the Spit at Southport, which has been formed in the last sixty years, grid boring by Mineral Deposits Syndicate in 1951 revealed no values of consequence except within a 300 ft. eastern strip where several small areas containing average values approximating 1% heavies to depths of 4 ft to 16 ft were defined. No deeper values were found to 5 ft. below water level. These areas would be of mining interest only at greatly increased prices or under radically different mining methods. A small area just north of the Main Beach Pavilion, adjoining a former site of the Nerang River mouth, contained rather higher values (average about 3%). It was worked by Mineral Deposits Pty. Ltd. in 1956-57. Scout drilling by C. J. Foyster confirmed the poverty of the western part of the Spit.

"Back" Areas

The "back" areas worked between Coolangatta and Tugun and at Burleigh and North Nobby (Gordon's) are undoubtedly old strand line deposits associated with sand-spit growth, and at Gordon's an old dune is well preserved. Average values worked have been 2 to 5% heavy mineral, to depths of from 6 ft to 20 ft. These areas have been closely test-bored by Mineral Deposits Pty. Ltd., and workable ground is nearing exhaustion.

In the Coolangatta-Tugun "back" area the dune ridges are largely eroded. There were a few rich seams, but it would appear that the heavy minerals have been largely redistributed by estuarine turbulence in what is believed to be a former outlet of Cobaki Creek. For this reason it is considered that Gardner's deduction of deposits of a – 5 ft sea is not conclusive. There was marked enrichment at the northern end near Tugun rail station, where average heavy mineral content was 12 to 15%, with locally up to 25% over 17 ft depth. (See Brooks 1953). The heavy mineral in this area contained nearly 50% ilmenite with about 25% rutile and 25% zircon, much of the latter being somewhat iron-stained. From this and from their height above sea-level Brooks concluded that they were formed during the mid-Recent emergence. The deposits behind Bilinga were much lower in ilmenite and of comparable composition to those in the coastal dunes. They are believed to be of younger age, related to sea levels approximating the present.

A notable feature of these "back" areas is the occurrence of several layers, a few feet thick, of "indurated" sand—firmly cemented by iron oxide and/or brown to black organic matter and often including roots and other woody fragments. These obviously represent old, probably swampy, land surfaces. These hard layers, which alternate with normal unbonded sand, bear no relation to heavy mineral distribution; but they have had an important influence on mining, often determining the lower limit of suction dredging and, where carrying heavy minerals adding to the costs of mining and of recovery of the minerals.

Other parts of the coastal plain between Coolangatta and Southport have been scout bored by various interests. A few bores were put down at Elanora, Stephen's Swamp and Merrimac by Australian Mining and Smelting Co. Ltd. in 1947 and behind Little Tallebudgera Creek by the Bureau of Mineral Resources in 1948. Subsequently the areas were covered more fully by Mineral Deposits Pty. Ltd. in 1953-56 and, in part, by Australasian Oil Exploration Ltd. in 1956-57. All bores were in sand, beneath a thin cover of loam or peat, to depths approximating low water level (i.e., 10 to 25 ft), with a few deeper holes (60 ft or more) to bedrock. Many bores bottomed on gravel or indurated sand. In flat areas, e.g., Stephen's Swamp, Merrimac Flats and Bundall, boring is reported to have been on generally open spacing. Heavy mineral contents were generally about 0·5% or less.

Denuded dune remnants behind Mermaid Beach, at Bundall and near the Southport Golf Links were grid-drilled by Mineral Deposits Pty. Ltd. but although a few intersections showed appreciable values, average heavy mineral content was indicated to be less than 1%.

Along the western margin of the coastal plain the only surviving dune remnant extends for ¾ mile south from Elanora rail station. This remnant was grid-drilled by M.D.P. and a small area defined in which a moderate thickness (up to 12 ft) of sand (including old beach seams), over gravel, contains average values slightly less than 3%. The area has now been mined (ML app. 331).

Production has been by three main companies, with small additions by several other interests.

Mineral Deposits Pty. Ltd. have worked beaches between Burleigh and Southport and at Flat Rock Creek, dunes between Burleigh and Broadbeach and on the Spit and "back" areas between Coolangatta and Tugun, and at Burleigh and Miami. Their current mining titles cover beaches at Miami (DC 34), Surfers Paradise (DC 36), The Spit (DC 37, DLs 66 and 138) and Flat Rock Creek (DL 97, ML 171), dunes at Miami (DL 65), the Elanora inland dune (ML 331), and several small "back" areas at Tugun and Kirra. They have also worked Commonwealth land at Bilinga.

Associated Minerals Cons. Ltd. have worked beaches and dunes between Burleigh and Broadbeach and still hold DCs 22 and 23 covering the beaches there and DCs 32 and 33 and DL 39 on the Broadwater foreshores.

Rutile Sands Ltd. production has been from beaches between Kirra and Tallebudgera (amal. DCs 42 and 43 and DLs 44, 45, 47, 51, 52 and 53) and dunes at Tallebudgera (DC 20).

Neumann and Casey hold DLs 3, 40 and 47 on foreshores between Kirra and Currumbin.

Australasian Oil Exploration Ltd. in 1957 worked Foyster's MLs 413, 415 and 571 at Tugun.

2. SOUTHPORT—LOGAN RIVER

(a) Mainland between Southport and Logan River

In the *Coombabah* area north of Southport there is a system of denuded meridional sand ridges alternating with generally low-lying swampy ground. Alluvial Prospectors Ltd. in 1947 sank five holes to depths ranging from 40 ft to 70 ft, and the Bureau of Mineral Resources tested the area to ground water level (Gardner 1955). Little heavy mineral was found in the sandy flats. Later the sand ridges were extensively hand-bored by Mineral Deposits Pty. Ltd. and Australasian Oil Exploration Ltd. to 3 to 5 ft below ground water level (up to 22 ft). One line of rig bores (3 chains spacing) was also drilled (M.D.P.) to depths ranging up to 60 ft along the surveyed road between portions 9v and 12v, parish Barrow. Indurated sand was met in many bores, at varying levels.

Only trace values were recorded except along the western side of the well-defined ridge (an old sand-spit) followed by the Paradise Point road, where grid drilling indicated average heavy mineral contents rather less than any yet worked, to approximately sea level over limited areas in the eastern part of portions 60, 7v, 6v and 5v. Details are not available, but the total tonnage involved is not large, and rutile content (22%) of the heavy minerals is somewhat lower than in South Coastal areas. The deposits are held under mineral lease applications 347-50 by Mineral Deposits Pty. Ltd.

An elevated sand area on the northern side of *Hope Island* probably represents old dunes. This was test-bored by C. J. Foyster in 1956, and contained no heavy mineral concentrations of commercial interest. Much of the remainder of the island is low-lying and sandy and scout bores revealed nothing of interest.

About 1 mile further north a few scout holes were also put down to depths of about 20 ft on a small dune remnant in pors. 36 and 38, parish Coomera, but encountered very little heavy mineral.

Sandy tracts in the *Jacob's Well* area show clear evidence of dune ridges. They were bored by Mineral Deposits Pty. Ltd. and again by C. J. Foyster in 1956, and it is reported that sufficient drilling was done to discard the area as of no economic interest for heavy minerals. Similar results attended testing by Mineral Deposits Pty. of sandy areas on resubs. 1–4 sub. 2, portion 5, *Pimpama,* and on pors. 212 and 215, parish Albert, near *Steiglitz.*

(b) The Broadwater and Jumpinpin—Sea Bed and Islands

Some scout boring to depths of 12 ft to 23 ft in search of possible heavy mineral seams in the sandy bed of the Bay was carried out at Labrador, Hollywell, Jumpinpin, Jacob's Well and Canaipa Passage by J. Scott Moffatt in 1953-54, using a launch-mounted Banka drill and casing. Only transient thin low-grade (1–4%) concentrations in the topmost few inches of sand were located.

Extensive systematic testing of the Broadwater, the southern limits of Moreton Bay and numerous banks and islands therein was undertaken in 1957-58 by Associated Minerals Consolidated Ltd. In the seabed a barge-mounted jet drill bored holes to bedrock; on the banks and islands hand-drilling was employed. Between Jubilee Bridge and Woogoompah Island 127 jet-holes revealed within the Broadwater sand resting on a seaward-sloping rock basement at depths of from 20 to 70 ft. Sampling at 5-ft intervals indicated a fairly even distribution of heavy mineral in the sand in proportion usually not exceeding 0·1%. No concentrations of foreseeable economic value were located. The sand is often covered by mud. Indurated layers are common in the sand near the western margin of the Broadwater. (McKellar 1958).

Waterline traces of heavy mineral occur on many of the banks and islands but no significant local concentrations were found. On sandbanks in the Nerang estuary and at Jumpinpin sludging to 5 ft depth revealed average values not significantly greater than in the Broadwater itself.

McKellar noted a general absence of evidence of former strand-lines within the area (with the possible exception of the Woogoompah dunes—see below), and concluded that if such ever existed any associated heavy mineral concentrations have been dispersed.

Dunes on *Woogoompah Island* were thoroughly test-bored in 1956 by W. D. Mott on behalf of Uranium Consolidated N.L. and again in 1957 by Associated Minerals Consolidated Ltd. Holes were up to 15 ft deep, and many bottomed on grey clay or mud. A little heavy mineral was found beneath the westernmost dune, but average grade was generally less than 0·1%.

A spine of dunes rising from generally low-lying *Crusoe Island* was also bored by Associated Minerals to depths up to 20 ft. Of twenty-four holes, the best showed 0·26% heavy mineral.

AUTHORITIES TO PROSPECT, BROADWATER

..	J. Scott Moffatt	Broadwater and southern limits of Moreton Bay	1953–54
20M	Associated Minerals Consolidated Ltd.	Broadwater and southern limits of Moreton Bay	1956–58

(c) South Stradbroke Island

The island is composed entirely of loose sand, apparently resting on a former sea floor. On the western beach at the north end fragments have been observed of an open-textured sandstone unlike anything on the adjacent mainland, whose origin is unknown. Of thousands of bores throughout the island, including many to 20 ft below sea level, not one has encountered basement rock or indurated sand. There is a sharp demarkation at about sea level between the beach and dune sand and underlying finer-grained white sand.

The island consists of (1) a coastal belt, averaging 20 chains wide, of migrating dunes largely devoid of vegetation and averaging 30 ft in height, actively encroaching on (2) a belt of older heavily vegetated partly denuded dunes averaging 15 ft height and showing marked north-south parallelism in the central part of the island; and (3) swamp and tidal flats along the western side. Erosion of the east coast and westward migration of large quantities of sand are quite spectacular.

Heavy mineral concentrations on the ocean beach are patchy and transient, and do not compare in size with those further south. J. H. Reid, Consulting Geologist, estimated total reserves of 40,000 tons of heavy mineral in 1949 (Gardner 1955). A few thousand tons have been won by Associated Minerals since 1952 from the northern half of the beach, this constituting most of the production from the island to date. Dune-erosion in active progress must be making some addition of heavy mineral to the beach.

Reconnaissance testing of the coastal dunes by lines of bores at wide intervals (4,000 ft, 1,000 ft and 4 chains) was carried out on three occasions—twice by Associated Minerals Pty. Ltd., in 1948-49 (in co-operation with the Bureau of Mineral Resources) and in 1953, and once by Mineral Deposits Syndicate in 1951-52. This indicated generally very low values of little commercial interest at the time, but Associated Minerals located buried concentrations in two areas: (*a*) small buried seams in what became known as the "trough area" between 5 and 7 miles from the northern end—a section of former strand line 100-300 ft behind the beach at that date and separated from it only by a narrow foredune, since largely eroded (BMR 1948-49); and (*b*) buried patchy low-grade concentrations 6 in to 3 ft thick in an area some 4 miles from the northern end extending up to 16 chains inland, working of which was attempted in 1954-55, with disappointing results.

More recently, the whole of the island was covered by Associated Minerals Consolidated Ltd. in 1956-57 by bores on a 6-chain grid, with detailed boring in several areas. Drilling was by hand auger with casing and sludge pump to mean sea level. As a result it is indicated that the old vegetated dunes contain for the most part less than 0·1% heavy mineral, and about 20% of the migrating dunes average less than 0·5%; but along two former strand lines beneath the migrating dunes there are several areas in which buried beach seams, individually up to 12 in and collectively up to 10 ft thick, in conjunction with overlying wind-blown deposits aggregate more than 1% heavy mineral in substantial tonnage. The entire area of migrating dunes was estimated to contain 20 million cu yd of grade 0·8% heavy mineral to mean sea level. The more westerly of the buried strand lines is 2 to 5 ft above present level. The other is at a level comparable to today's beach; it includes the western margin of the "trough area". Average composition of the heavy minerals determined by grain count was given as:

Zircon	27·8%
Rutile	33·5%
Ilmenite	32·5%
Others	5·7%

The beach and dune areas are included in Special Mining Lease 937 held by Associated Minerals Consolidated Ltd.

Low-grade wind-blown disseminations were located, to about 10 ft depth, in low dune areas on the central western side of the island (freehold portions 1, 12 and 13), but particulars are not available.

AUTHORITIES TO PROSPECT, SOUTH STRADBROKE ISLAND

..	Associated Minerals Pty. Ltd.	coastal dunes	1948–49
..	Mineral Deposits Syndicate	coastal dunes	1951–52
..	Associated Minerals Pty. Ltd.	coastal dunes	1953–54
20M	Associated Minerals Consolidated Ltd.	whole island	1956–58

3. MORETON BAY

(a) North Stradbroke Island

This island is of particular importance in that it contains by far the largest known reserves of heavy mineral sand in the State and our only appreciable remaining known reserves of high rutile-zircon low-ilmenite sand of presently workable grade.

The greater part of the island is composed of vegetated high sand dunes with marked north-westerly trends, whose eastern margin forms a scarp which is obviously an old strand-line. Along the eastern coast is a belt of younger lower dunes up to 300 yd wide in which encroachment by still-active transgressive dunes is well advanced on remnants of an earlier vegetated series paralleling the coast. Between the high dunes and the coastal belt the northward-tapering Eighteen Mile Swamp forms a prominent feature. On the northern and western coasts of the island are fringes of tidal swamp. Rock outcrops are limited to Mesozoic rhyolite around Point Lookout, Mesozoic sandstone at Dunwich and lower Palaeozoic greenstone below high-water mark at Canaipa Passage opposite Russell Island.

In the giant dunes Gardner claimed to have recognized five growth stages which he equated with various sea levels of Pleistocene and earlier Recent times. In view of the ease of migration of sand as "blow-outs" the validity of such correlations is perhaps open to doubt, and requires checking by other means, e.g., radio-carbon age determinations of the beds of carbonaceous sand-rock occurring in the dunes. Cribb (1958) has described a peat bed near Amity possibly dating back to the Pliocene. For further details reference should be made to Gardner's work (1955).

The whole island has been covered by scout prospecting by various interests, but the outstanding event has been the development by The Zinc Corporation Ltd. and its subsidiaries, from initial exploration in 1947-48, of an important soundly-based production industry embracing all stages from mining to final separation at the Dunwich plant. The operating company is Titanium and Zirconium Industries Pty. Ltd. (TAZI), who carried out extensive exploratory drilling from 1948 to 1953 and commenced production in 1950.

Small amounts of heavy mineral are still recovered from the ocean beach, and important quantities, in medium-grade deposits, occur in the coastal dune areas. A large part of known reserves, however, is in very low-grade deposits in the vegetated giant sand dunes, TAZI hold Special Mining Lease No. 931 covering most of the beach, coastal dunes and high dune areas of possible commercial interest.

(1) *Beach.*—Unlike other parts of the coast, black sand concentrations at the northern end of the eastern beach, within 5 miles of Point Lookout, are negligible. Further south intermittent rich seams were found to be more widely distributed than early reconnaissance suggested. Many bores to 6 ft below mean sea level entered barren coarse quartz sand. These seams were worked by TAZI by hand-shovelling methods, and from 1952-55 supplied to a pilot plant at Dunwich about 100,000 tons of concentrate from which some 25,000 tons of rutile was recovered. A little black sand deposition still occurs periodically as a result of natural reworking of the beach and eroded dune sand (including tailings from dredging of the coastal dunes). It is notably less where the frontal dune has been worked.

Average heavy mineral composition in the eastern beach was calculated (Connah, 1948) as:—

Zircon	31%
Rutile	37%
Ilmenite	31%
Monazite	0·2%

No economic concentrations have been found along the beaches on the northern and western sides of the island, where black sand skins at high-water mark are high in ilmenite (over 50%). Reference is made below to exploration of coastal dune and swamp areas behind the northern beach.

(2) *Coastal Dunes.*—Deposits in the belt of coastal dunes may be considered under two heads:

(i) Newer Coastal Dunes—The existence of black sand seams beneath the coastal dunes in the southern half of the island was recorded by Connah (1948). Subsequent investigation by TAZI, following storm exposures in 1950, revealed extensive deposits along the section between 7 and 16 miles south from Point Lookout, and that an eastern strip some 250 ft wide could be economically dredged over an unbroken length of 8 miles. The heavy mineral occurs mainly in a 3 to 4 ft thickness of small rich seams a few feet above mean sea level, with low values in the overlying dune sand and no appreciable values to 5 ft beneath. Further west smaller concentrations indicate a still earlier strand-line 500 ft behind the beach, but average values there appear to be below present working limits.

With commencement of working of these coastal dunes in 1956 TAZI initiated a greatly-expanded scale of production. Up to 1960 some 65,000 tons of rutile was produced from dredging over a continuous length of 3 miles. Heavy mineral composition is approximately:—

Zircon	25%
Rutile	38%
Ilmenite	30%
Monazite	0·18%
Others	7%,

rutile increasing westwards from 32% to over 40%.

Grid drilling by Australasian Oil Exploration Ltd. indicated an extension of comparable low values in a 3-chain strip of coastal dunes extending for 2 miles north of the above area. The company estimated that this strip contains some 40,000 tons of heavy mineral, composition being given as 30% rutile and 40% zircon. This is held as DL 146.

On the northern side of the island, between Point Lookout and Rocky Point (DL app. 81—A. H. Clayton) TAZI proved appreciable quantities of sand containing from 4 to 8% heavy mineral in deposits around mean sea level. The heavies contain 8 to 16% rutile, a typical grain count being:—

Zircon	16·6%
Rutile	13·5%
Ilmenite	60·1%
Magnetite	7·5%

(ii) "Back Run" area, a belt of low parallel dunes between the recent beach dunes and the older high dunes, between Point Lookout and the head of the Eighteen Mile Swamp. This is clearly an old strand-line area, whose extension southwards has been destroyed by creek erosion. Buried rich seams were discovered in this area during early Zinc Corporation exploration, and subsequently were drilled in detail by TAZI.

Within a belt 200 to 600 ft wide roughly parallel to the coast, three distinct old beach lines were defined, overlapping in the southern part but in the north separated by almost barren zones. The southern limit of the concentrations is sharply defined. The major concentrations occur at or just above sea level, with some evidence of a slight rise in sea level as the strand progressed eastward. Sufficient deep drilling (to maximum 30 ft below sea level) was done to establish that no economic concentrations occur lower than 6 ft below sea level.

Over a length of approximately 3 miles commencing ¾ mile south of Point Lookout, the Company's work indicated the possibility of production of something in excess of 200,000 tons of heavy mineral, of composition:

Zircon	14%	
Rutile	22%	(locally up to 40%)
Ilmenite	58%	
Others	6%	

Dredging was attempted in 1950-52, the working thickness being 6 to 8 ft, but was abandoned in favour of rich seams on the beach. The future of this deposit is clouded by the effects of rapid encroachment by active dunes and by the presence of a good deal of buried timber.

The heavy mineral composition is markedly different from that in the coastal dunes and relates these deposits to an earlier stage of coastal evolution.

(3) *Giant Dunes.*—Early reconnaissance drilling indicated a small heavy mineral content over much of the vegetated giant dunes, but it was quickly established that the principal sphere of economic interest is confined to the later dune stages on the eastern side within 12 miles south from Point Lookout and no more than one mile inland from the edge of the dunes. Within this area there are indicated to be very large reserves of a grade not presently economic but which are of importance for possible future exploitation.

Extensive reconnaissance drilling of the high dunes included in SML 931 suggests that there could be, to mean sea level, something of the order of 10,000,000 tons of heavy mineral at an average grade of 0·7%. Highest values were generally found on the ridge crests, to which earlier drilling was largely confined. Systematic drilling in two areas chosen for closer study revealed sporadic concentrations of above-average grade which might possibly be selectively minable.

Average heavy mineral composition in these high dunes is calculated as:—

Zircon	17%
Rutile	28%
Ilmenite	51%
Monazite	0·12%
Others	3·88%

Four holes near the eastern margin of the high dunes showed sand continuing to 50 to 60 ft below mean sea level with heavy mineral content less than 0·5%.

Similar low-grade wind-concentrations were revealed by AOE in sand ridges about 40 ft high in the southern part of R. 1362, about 1 mile west from Point Lookout. Grid drilling, however, was confined to higher values within a small area of some 8 acres apparently atop one main ridge, and reserves therein to 40 ft depth were estimated at about 30,000 tons of heavy mineral at a grade of 4·85%.

(4) *Swamp Areas.*—Scout boring by Zinc Corporation and later by TAZI and AOE located no economic concentrations in the Eighteen Mile Swamp, nor on its western margin, which obviously represents an old strand line. Any beach concentrations along this line apparently have been completely removed by stream and/or wind erosion.

Scout boring by AOE in 1957 of the swampy land behind the northern beach likewise found only traces of heavy mineral.

On Stingaree Island at the southern end of North Stradbroke, a number of scout bores by C. J. Foyster in 1956, to depths up to 20 ft, located no economic concentrations, most of them penetrating mud carrying only traces of heavy mineral.

AUTHORITIES TO PROSPECT, NORTH STRADBROKE ISLAND

..	Australian Mining and Smelting Co. Ltd.	whole island	1947–48
..	T.A.Z.I. Pty. Ltd.	north-eastern third	1948–53
..	Mineral Deposits Syndicate	southern part	1952–53
48M	Beach Minerals Pty. (C. J. Foyster)	Stingaree Island	1956
98M	A.O.E. Ltd.	18-mile swamp and southern end	1957
111M	A.O.E. Ltd.	swamp, northern end	1957

(b) Moreton Island

The physiography and geological features have been referred to by Marks (1924) and described more fully by Richards (1937) and Morton (1948). Briefly, the island consists for the most part of vegetated giant transgressive sand dunes similar to those on North Stradbroke, attaining in Mt. Tempest the remarkable height of 924 ft. The only rock outcrops known are around Cape Moreton, and comprise volcanics (rhyolite and andesitic agglomerate) and Mesozoic coaly sandstone and shale. Over much of the island the high dunes extend almost to high water mark. Its southern end is generally low-lying, and along the

north-western shores is a fringe of swamp. On the north-east, for 5 miles south of Cape Cliff, low jumbled dunes extend inland for some ½ mile behind the beach.

Unlike North Stradbroke there are apparently no economic concentrations in the vast volume of sand forming the main mass of the island. Apart from the common black sand seams on the beaches, the main sphere of interest is the low dune area between Cape Cliff and Eagers Creek. A separation plant erected near Tangalooma Point by Zircon Rutile Ltd. and Whale Products Pty. Ltd. in 1956 was operated from 1957 to mid-1958 by Tangalooma Minerals Pty. Ltd. on black sand scraped from the eastern beach.

(1) *Eastern Beach.*—Intermittent black sand deposits occur along much of the eastern beach. Some 15,000 tons of heavy mineral have been produced from these deposits. No reliable estimate of reserves remaining is available, but at least another 20,000 tons may reasonably be expected.

Eighteen miles of the eastern beach is held under mining titles:—

DLs 27-30 and 75 Tangalooma Minerals Pty. Ltd.

DLs 119, 120, 122 Zircon Rutile Ltd.

Heavy mineral composition given by Gardner (1955) is:—

Zircon	23%
Rutile	18%
Ilmenite	58%
Monazite	0·9%

(2) *Western Beach.*—Black sand concentration is common along the western beach of Moreton Island, presumably because of exposure to tidal and wind influences. The seams do not extend beneath the truncated dunes, and are apparently formed by re-working of sand eroded from these dunes. L. C. Ball, consulting geologist (1949), in a report to Moreton Island Minerals Pty. Ltd., recorded a common thickness of 3 ft at high-water mark containing from 2% to 75% heavy mineral, whose composition averaged 80% ilmenite, 10% rutile and 10% zircon. Based on exposures about high-water mark and assuming a seaward-tapering width of 10 yd, Ball calculated "possible" reserves over a length of 12 miles south from Cowan Cowan Point of 220,000 tons averaging 7% heavy mineral, the richest sand being over a 2-mile section about Tangalooma Point. The grade so estimated must be regarded as speculative, and requires confirmation by detailed testing.

These beaches are held by Tangalooma Minerals Pty. as DLs 32-36.

An interesting and almost unique occurrence of low-grade concentrations lies in an extensive sand bank between high- and low-water marks on the south-western end of Moreton Island. The bank is reported to be the meeting place of tides from northern and southern ends of Moreton Bay, to which the deposition of heavy mineral may be attributable. Scout boring was carried out by D. A. Pitman in 1956 on behalf of Rutile Minerals Ltd. (F. A. O'Sullivan) to 6 ft depth over an area of 2 miles x ¼ mile west from high-water mark, from which a fairly even distribution of heavy mineral estimated at about 1·5% was suggested. Its composition averaged about:—

Zircon 15-30%, Rutile 15-20%, Ilmenite 50%, as well as 10-20% magnetite. The appreciable magnetite content is in contrast to the ocean beach and dune sand, and indicates derivation from local land drainage. Much more detailed investigation is required to assess the deposit in extent, depth and overall grade.

(3) *Coastal Dunes.*—Scout boring by TAZI in 1952 suggested that the only area of economic interest is the strip some 1,000 ft wide extending for 5 miles south from Cape Cliff. Open-grid boring in the northern third of this area, where values appeared to be highest, indicated some 175,000 tons of heavy mineral in a deposit of low overall grade, with composition:—

Zircon	14·3%
Rutile	24·7%
Ilmenite	56·4%

There may be further low-grade reserves in the southern part of this strip. Some further grid drilling has been done by Zircon Rutile Ltd. in 1956 after acquisition of the lease from TAZI.

The dune areas of interest are held as SML 930 by Tangalooma Minerals Pty. Ltd., and were formerly included with areas on North Stradbroke in SML 339 held by Titanium and Zirconium Industries Pty. Ltd.

(4) *Giant Dunes.*—Reconnaissance boring was first carried out by Australian Mining and Smelting Co. Ltd. in 1947. Subsequently more systematic scout drilling was done to depths of 20 ft by J. Scott Moffatt in 1949 and to 30-40 ft by TAZI in 1952 and Tangalooma Minerals Pty. Ltd. in 1957. The net result is that no concentrations of possibly economic grade are known within these dunes, values almost everywhere being much below 1% heavy mineral. A few holes immediately behind Kounungai on the south-west coast showed somewhat higher values, but systematic scout boring indicated an average less than 1% (T.M.P.L.) It seems likely that these somewhat higher concentrations are a function of the reworking of larger volumes of sand wind-swept westwards from the bare Big Sand Hills.

Authorities to Prospect, Moreton Island

..	Australian Mining and Smelting Co. Ltd.	1947–48
..	T.A.Z.I. Pty. Ltd.	1948–53
..	J. Scott Moffatt (Southern half)	1948–49
6M	Whale Products Pty. Ltd.	1954–55
19M	Zircon Rutile Ltd.	1956
82M	Tangalooma Minerals Pty. Ltd.	1957

(c) The Bay and Adjacent Mainland

Moreton Bay appears to be a relatively old feature of the coastline, extending back at least to a general foundering movement of over 100 ft which presumably post-dates the Tertiary volcanic activity. A subsequent small emergence is indicated by raised platforms

at Nudgee, Shorncliffe, Brighton, Cowan Cowan (Moreton Island) and elsewhere, and the existence of dead reef coral in place above present low-water level at several islands within the Bay (Stutchbury 1854; Wells 1955).

Any coastal sand accumulations formed during this evolution have apparently been completely eroded, with the exception of a typical coastal dune at Beachmere, an old dune 1 mile behind it, and a complex of dunes on the southern end of Bribie Island. Thin skins of black sand form at times on the more exposed sections, e.g., Redcliffe Peninsula and Beachmere. It is not known that any of these dunes have been test-bored. Conditions differ, however, from the long sweeps of coastline with oblique ocean-wave action which favour commercial concentrations.

Scout drilling of the floor of *Deception Bay* by Australasian Oil Exploration Ltd. in 1956 indicated only a couple of feet of sand resting on mud. The sand carried about ½% heavy mineral, with a notably high rutile content of about 40%.

Scout boring of the sea-bed off-shore between *Wynnum* and *Wellington Point,* to depths not exceeding 15 ft, was carried out by J. Scott Moffatt in 1956. Heavy mineral content ranged from traces to 2% and averaged less than 1%. That recovered from sand in Waterloo Bay was reported to contain 56% zircon and 40% ilmenite, with very little rutile.

Attempts were made during 1957 to drill shallow-water banks in at least three areas of the bay itself—North and Wild Banks off Bribie Island, banks some 4 miles south of Bribie Island and off the southern end of Moreton Island. Operational difficulties limited penetration of sand to about 8 to 10 ft. Negligible heavy mineral content was recorded.

AUTHORITIES TO PROSPECT, MORETON BAY

..	J. Scott Moffatt ..	Southern portion ..	1953–54
45M	J. Scott Moffatt ..	Foreshores, Wynnum–Wellington Point	1956
60M	Australasian Oil Exploration Ltd.	Deception Bay ..	1956–57
73M	A. B. Black and N. Lohmann	Bank 4 miles south of Bribie	1957
75M	Ipswich Minerals Pty. Ltd.	North and Wild Banks and Hamilton Patches	1957
93M	Pacific Enterprises Pty. Ltd.	Skirmish and Salamander Banks (no work done)	1957
108M	Collier Garland Equipment Pty. Ltd.	Bank off Moreton Island	1957–58

(d) Bribie Island

Bribie Island is generally low-lying and composed entirely of sand and unconsolidated sediments. No rock outcrops are known though the presence of underlying Mesozoic rocks is inferred from mainland outcrops at Toorbul Point, Donnybrook and Caloundra just across Pumicestone Channel. Carbonaceous sand-rock is common at varying shallow depths. Many bores on the eastern side of the central inland ridge (see below) are reported to have met coarse gravel at depths less than 20 ft, i.e., not far below present sea level.

Except at the northern and southern ends the coastal dune is a very narrow fringe encroaching westwards on wide low sandy tracts in much of which there is a striking pattern of longitudinal ridges, in a broad arcuate sweep, only a few feet above their swampy surroundings; these, it is suggested, represent not denuded dunes but raised off-shore sand banks. North from Mermaid Lagoon these are truncated by a later trend parallel to the coast. The western half of the island is occupied by muddy sediments and swamp. In the centre of the island, however, there are two well-defined old dune ridges—undoubted former strand lines—oblique to the present coast. These are referred to as the central and western ridges. The southern end of the island is a later considerable accretion composed of dune sand and raised banks with complex trend-pattern. The whole island has apparently evolved in Recent times.

Scout boring was carried out along the east coast in 1951 by Australian Mining and Smelting Co. Ltd. In 1954-55 TAMCO did some reconnaissance drilling over the eastern part and along the central and western ridges. Subsequent investigations have covered most of the island in reconnaissance and the central ridge area in somewhat more detail, and have been principally by Mr. J. Scott Moffatt and associates. As a result, there are known to be very limited resources on the eastern beach and the northern sand spit, but deposits of greater prospective value are indicated along the central inland ridge.

(1) *Beach and Coastal Dunes.*—Intermittent black sand deposits from 1 to 6 in thick are reported to form periodically on the ocean beach. Boring by Enterprise Exploration Co. Pty. Ltd. and later by TAMCO has shown that thin seams exist to depths not exceeding 4 ft over the northern 11 miles of the beach, in places extending beneath the frontal dune. Over this length of beach partial estimates suggest an aggregate of some 25,000 tons of heavy mineral at grades of 10 to 15%. Its composition is given as:—

Zircon	20%
Rutile	24%
Ilmenite	53%
Others	3%

It is doubtful if these deposits could be worked economically under present conditions. A 13-mile section of the beach (north from Dingo Creek) is covered by DL applications 17, 18, 88, 89, 90 and 143 in the name of Mineral Deposits Pty. Ltd. A further section of ½ mile at the northern end is held as DL app. 160 by J. Scott Moffatt.

In the frontal dunes reconnaissance drilling by TAMCO indicated a few small areas of economic grade over a distance of 6 miles south from Bribie Light. The tonnage would not be large, but forms a valuable addition to the beach deposits. The area is covered by DL app. 149 (TAMCO).

Elsewhere in the coastal dunes values of economic interest have been located only over the northernmost 1 mile, where J. Scott Moffatt reports drilling to 10 to 18 ft below water level in dunes from 3 to 15 ft high. Buried lenticular seams were located over an eastern strip 1½ chains wide, but detailed drilling is required to estimate tonnage and grade. Composition of the heavy minerals is given as:—

Zircon . .	. . 28%
Rutile . .	. . 19%
Ilmenite . .	. . 41%
Others . .	. . 12%

(2) *Inland Dune Ridges.*—Reconnaissance drilling by J. Scott Moffatt along the eastern side of the central inland ridge has revealed buried concentrations which are obviously old strand deposits. They appear to be only of moderate grade, but the overlying and, in some cases, underlying sand is reported to carry appreciable values. Open-spaced lines of holes over a length of some 2 miles at the northern end of the ridge have indicated average values of economic interest to depths of from 5 to 20 ft. Holes were mostly taken to 25 ft and many encountered gravel at elevations that must be little below present sea level. Scout bores suggest that the deposits may extend southwards along the ridge and along a severed extension to the north towards Bribie Light. Average heavy mineral composition is reported as:—

Zircon . .	. . 26%
Rutile . .	. . 19%
Ilmenite . .	. . 42%
Others (including quartz) . .	. . 13%

This initial testing indicates substantial tonnages of heavy mineral, but systematic grid drilling is required to define workable areas and to positively assess reserves and grade. Special research will also be necessary into the economics of mining and separation, having regard to the frequency of hard indurated sand, the heavily coated or stained condition of many of the grains and the isolated situation. A spiral concentrating plant has been partially erected. The deposits have been applied for as DL Nos. 152, 153, 159 by J. Scott Moffatt.

The western inland ridge has been scout-bored to depths of about 12 ft by TAMCO and later by W. D. Mott, Consulting Geologist, for D. B. Duncan (1956), without revealing anything of commercial interest. Drilling by W. D. Mott about Bribie township indicated, over a ¼ acre on the western side of Block V, average values of from 2 to 9% heavy mineral to depths up to 12 ft. This apparently is a small wave concentration opposite the widest, most exposed part of the Pumicestone Channel. The quantity of minable rutile was estimated to be not more than 300 tons. Heavy mineral composition was given as:—

Zircon . .	. . 18%
Rutile . .	. . 19%
Magnetic minerals . .	59%
Others . .	. . 4%

On a low ridge about 1 mile east from the mouth of Cobbler's Peg (or Dux) Creek, seven lines of holes reported by Rutile Productions Pty. Ltd. in 1958 showed an average of 3% heavy mineral to depths of 20 to 30 ft. Indurated sand was reported at 20 to 30 ft, and gravel from 30-35 ft.

There is no record of any testing of the well-defined dune ridges traversed by the Bongaree–Woorim Road. These, by reason of their situation at the southern end under some protection from Moreton Island do not appear very favourable for significant heavy mineral concentrations.

(3) *Sandy flats.*—Scout bores and open-spaced line drilling along the eastern side (by TAMCO, 1955 and 1957; J. Scott Moffatt 1957-58 and 1960-61) have shown values generally less than 1% except immediately south from the old Bribie Light, where J. Scott Moffatt reports a wide spread of low-grade sand to a depth of 30 ft, averaging perhaps 2% heavy mineral, with sporadic patches of slightly higher grade. The western section of the island has been likewise scout-tested (J. Scott Moffatt 1957-58 and D. B. Duncan 1956). Behind a sandy western fringe there are wide clay pans.

AUTHORITIES TO PROSPECT, BRIBIE ISLAND

. .	Australian Mining and Smelting Co.	Eastern side . .	1950–51
39M	TAM Co.	Eastern half . .	1954–58
47M	D. B. Duncan . .	Western side . .	1956
65M	J. S. Moffatt . .	Eastern half	1956–57
95M	J. R. Henley . .	South of Dingo Creek	1957
105M	A. Shackman . .	South of 95M . .	1957
114M	J. S. Moffatt . .	Eastern side . .	1957–59
119M	Rutile Productions Pty. Ltd.	Cobbler's Peg Creek area	1958
126M	A. W. Graham . .	Eastern side . .	1958
137M	J. Bryce	Eastern side . .	1959
139M	J. S. Moffatt . .	Eastern side . .	1959–60
167M	J. S. Moffatt . .	Eastern side . .	1960–61

4. CALOUNDRA—NOOSA

This section of the coast is characterized by three almost straight sandy beaches between rocky headlands. These headlands and the basement rocks forming the western edge of the coastal plain are predominantly Mesozoic sandstones, intruded in a few places by granitic and trachytic rocks and overlain at Buderim by basalt. For details of the geology of the area reference should be made to unpublished theses by J. T. Woods, Miss B. Houston and the Science Students Association in the Geology Department, University of Queensland.

The coastal dunes form a narrow fringe encroaching on the low plain of the Mooloolah and Maroochy Rivers. This plain consists of estuarine swamps and sand ridges resting on a shallow basement of Mesozoic sandstone. For 2 miles south from Point Arkwright the dunes attain heights of 50 ft or more and extend westwards towards Mt. Coolum. South from Paradise Caves higher transgressive dunes of Cooloola type (see later) stretch inland for a mile or more in a southward tapering triangular area 6 miles long.

Between Caloundra and Noosa Headland carbonaceous sandrock and peat with gentle eastward slope commonly occurs at the foot of the dunes and extends across the beach, often being exposed by seasonal changes in beach profile. Bedrock also outcrops in places, and extends seawards to shoals. It is apparent that the swampy lowland once extended further east with sea level rather lower than today. The evolution of the coastal plain appears to have been essentially an emergence of the order of 10 ft with a subsequent slight rise of sea level. Evidences of former stable strand-lines are generally lacking within the coastal plain, except for a small crescentic area of denuded dunes behind Golden Beach at Caloundra which does not appear to have been tested, and, possibly, small areas near Bli.Bli and Mt. Peregian.

Following the reconnaissance work of the Geological Survey in 1947, these areas were investigated in detail by Mineral Deposits Syndicate and later by Australasian Oil Exploration Ltd. These repeated examinations have indicated that the beaches between Caloundra and Noosa do not contain important reserves of heavy mineral. Concentrations do occur but they are small and irregular, and limited to small sections of the coastline. Individual deposits are unlikely carrying more than a few thousand tons of heavy mineral. The richest accumulations are within 1 mile south from Paradise Caves and in a 2-mile section opposite Mt. Peregian where in 1949 seams 6 to 30 in thick carrying 40 to 50% heavy mineral were located at the top of the beach beneath 3 to 14 ft of overburden. Other deposits delineated in 1955 were within 1 mile north of Currimundi Creek and within 2 miles south of Point Arkwright, in which the values occurred in thin seams within thicknesses of 4 to 5 ft of low overall grade (4 to 5%). On the southern side of Point Cartwright coarse shelly sand occurs with little heavy mineral. Erosion and redistribution of the heavy mineral during stormy periods is likely. Unlike southern beaches there is little addition from dune erosion, since there are no seams beneath the dunes. Heavy mineral composition was determined by M.D.S. as:—

Caloundra Zircon	21%	Rutile 18%	Ilmenite 55%	Others 6%
Coolum—Paradise Caves	18	15	64	3

During the rutile boom virtually the whole coast was pegged. Current titles, between Coolum and Noosa Head include DLs 5, 6, 98 (Gympie)—M.D.P.; DLs 18, 19—F. Paskins; and DLs 22 and 29—Uranium Holdings N.L. (Alexandria Bay).

The coastal dunes were scout-bored by A.O.E., particular attention being devoted to the larger developments to the south of Paradise Caves and Point Arkwright. In the former, bores were drilled to depths up to 50 ft; elsewhere sandrock or bedrock was met at shallow depth. Overall values generally were reported less than 1%, but grid drilling some 2½ miles south from Noosa Head defined two areas aggregating about ½ million tons carrying 1% heavies to 20 ft depth. A buried beach seam was located near Mt. Peregian; its limits were not determined, but it obviously is of small extent.

Sand banks in the Maroochy Estuary were test-bored by A.O.E. in 1956, and Lake Weyba, Weyba Creek and surroundings by other interests about the same time. Mud was met at shallow depths, and the overlying sand carried only traces of black sand. Other parts of the coastal plain offer no prospects of economic reserves of heavy mineral.

AUTHORITIES TO PROSPECT, CALOUNDRA–NOOSA

..	Mineral Deposits Syndicate	Coolum–Inskip ..	1949
9M	Mineral Deposits Syndicate	Caloundra–Coolum ..	1954–55
22M	Australasian Oil Exploration Ltd.	Coolum–Double Island Point	1956–57
23M	Australasian Oil Exploration Ltd.	Caloundra–Coolum ..	1956–57
51M	Australasian Oil Exploration Ltd.	Maroochy estuary ..	1956–57
58M	A. H. and A. C. Butler	Lake Weyba area ..	1956–57
66M	E. T. Johns ..	Weyba Creek ..	1956
69M	E. J. Freer ..	Caloundra–back areas	1956–57

5. NOOSA—INSKIP

Virtually the whole of this coastal area is occupied by sand, the only rock outcrops being the andesitic rocks forming Double Island Point, a few "islands" of Mesozoic sandstone in the low flats just north of Noosa, and post-Tertiary oil shale on the beach midway between these two. For several miles north from Noosa there is a narrow belt of coastal dunes backed by wide swampy flats. Northwards almost to Double Island Point the narrow beach is flanked just above high water mark by the high Cooloola sand mass, composed of uplifted loosely consolidated Pleistocene sands (the Teewah coloured sand) (Coaldrake 1959), overlain and underlain by drift sand which persists in one place to 200 ft below sea level (Ball 1924). This mass is remarkably similar in size and shape to the high dunes of North Stradbroke and Moreton Islands. Bands of Pleistocene to recent shells reported by TAMCO at elevations of 150 ft on its western side are suggestive of a past marine shore line. Within 3 miles south of Double Island Point, around the two high "islands" of consolidated sand from which the name is derived, are two areas of roughly parallel sand dunes rising to heights of 30 to 150 ft above sea level. Boring has proved these to be underlain by a westward-rising basement of consolidated sand.

At the northern end of the Cooloola mass, on the shores of Wide Bay, a system of low denuded parallel dunes forms the Inskip Peninsula. Both here and at the southern end of Laguna Beach sandrock is exposed on the beach and extends beneath the coastal dunes and swamp.

Behind the Cooloola mass the low-lying Noosa Valley with its lakes is apparently a raised marine passage between Noosa and Tin Can Inlet. It is bordered on the west by sandy wallum country which terminates westwards in the degraded Como Scarp in the Mesozoic sandstones, which is visualised as a stranded shoreline of the Pleistocene (Coaldrake 1959).

Evidence of former strand line deposition has been found near Hall's Hill 2 miles north of the Noosa mouth and possibly between there and Lake Cooroibah. Any such deposits which might have existed behind the Cooloola mass have been completely destroyed; one exception being a comparatively small area of denuded crescentic dunes on the north-west shore of Lake Cootharaba, which were formed presumably at a stage when this area was open to the sea between the Cooloola mass and Noosa Heads.

The Noosa–Double Island Point beach has been productive of a considerable tonnage of black sand and presumably there are further quantities available; but by far the most important reserves in this area lie in the Inskip Peninsula in low-grade inland deposits and in the northern sand spit.

Laguna Beach.—Transient black sand concentrations occur along the greater part of the beach between Noosa and Double Island Point, thickness of mineral-bearing sand being reported as from 6 to 30 in and carrying from 35 to 80% heavy mineral. Early testing by M.D.S. in 1949 and by Titanium Corporation of Australia indicated appreciable buried concentrations in a narrow strip between high-water mark and the high dunes in a central length of beach of some 21 miles. Since 1956 Titanium Corporation of Australia Pty. Ltd. has won, by selective hand mining, upwards of 50,000 tons of black sand from beach leases (including parts held by Mineral Deposits Pty. Ltd.) between 1 and 31 miles north of Noosa. Working depth averages about 4 ft. Average composition of the heavy mineral is approximately:—

Zircon	21%
Rutile	17%
Ilmenite	60%
Monazite	0·7%
Others	1·3%

but rutile falls in places to 12%. Small sporadic deposits of medium-grade were noted by A.O.E. on the southernmost 1 mile of Laguna Beach and similar deposits have been found immediately south of Double Island Point. (Connah 1948). No assessment of total remaining beach reserves has been attempted, but it seems safe to assume that at least a further 20,000 tons of heavy mineral is or will become available for selective mining.

The beaches are held under mining titles as under:—

DLs 7, 8, 9 (Gympie) Mineral Deposits Pty. Ltd.

DLs 11, 15, 23, 24, 25, 26, 67, 68, 84 Titanium Corporation of Aust. Pty. Ltd.

DLs 12, 13, 17 Uranium Corporation of Aust. Pty. Ltd.

Dunes.—Drilling by AOE on an open grid system indicated that the coastal dunes for some 7 miles north of Noosa carry average values generally less than 1%, except in a small area to the south of Hall's Hill where buried beach concentrations raise the overall grade to about 2½% to 7 ft depth. The dunes are underlain by indurated sand at about sea level.

It is not known whether any detailed testing has been done of the coastal dunes within two miles south of Double Island Point where buried rich seams were recorded by Connah (1948). Most of this, however, is in R. 699 Lighthouse Reserve; its southern extremity is in DL app. 20 (Zircon Rutile Ltd.), whose western boundary is 3 chains inland.

In an area of some 450 acres of sand dunes behind this and just south of R. 699 applied for as MLs 190–192 (now forfeited), scout boring by AOE in 1956 to depths up to 80 ft indicated wind-blown concentrations on the crests of the dunes, where average values to depths of 30 to 50 ft in individual holes were reported from 1½% to 5% heavy mineral, whose composition in two samples was:—

Zircon	23%
Rutile	17-23%
Ilmenite and magnetite	51-55%
Monazite	0·5%
Garnet, etc.	2-3%

Much more drilling is required to prove whether a workable quantity and grade exist. Isolation and difficult mining conditions would be adverse factors. Bores in the southern and western parts bottomed on consolidated sand.

Giant Sandhills.—Scout boring was carried out by TAMCO (1952) to depths of 20 to 50 ft along King's Bore road and by AOE (1956) to depths of 20 ft for 9 miles south of Double Island Point and at the southern end. Values generally were much less than 1% heavy mineral. It seems unlikely that useful reserves exist in these sand hills. The Teewah sands are virtually devoid of heavy mineral.

Inland Areas.—The flat swampy area to the north of the Noosa River mouth was grid bored by AOE but only traces of heavy mineral were found in the loose sand above sandrock at 5 to 7 ft depth.

The old denuded dune ridges on the north-west shore of Lake Cootharaba appear to be worthy of testing for possible black sand deposits. To the writer's knowledge they have not been so investigated.

Inskip Peninsula.—Extensive drilling by TAMCO of the dune system which forms the Inskip Peninsula has shown that though values are generally very poor in an eastern strip up to ½ mile wide, the dunes further west overlie beach concentrations 6 to 15 in thick over their entire length, resting at the southern end on a basement of sandrock at about 5 ft above mean sea level. In an area with maximum width some 400 yards and average depth 16 ft TAMCO estimates that there are some 420,000 tons of heavy mineral in low-grade sand of economic interest, with composition:—

Zircon . .	. . 16·6%
Rutile . .	. . 17·0%
Ilmenite . .	. . 62·5%
Others (inc. Monazite) . .	. . 3·9%

Considerable metallurgical research is being conducted by the Company into economic methods of treating the high-ilmenite sand of the Peninsula. The areas are covered by still-current (1961) Authority to Prospect 39M.

The ocean beach north of Eight Mile Rocks has not been drilled in detail, but is known to carry transient concentrations. On the basis of reconnaissance work by the Geological Survey (Connah 1948) it could be expected to contain about 20,000 tons of heavy mineral in a narrow zone of washings up to 2 ft thick. Zircon content is apparently slightly higher than in the inland dunes. This beach is covered by DL 14 (Gympie)—Crescent Rutile Ltd. (in the north) and DLs 41 and 50 (S. McKinnon). South from Eight Mile Rocks S. McKinnon holds DLs 40 and 49 on the narrow beach at the foot of the truncated giant dunes.

On the shores of the strait west from Inskip Point TAMCO estimated that there could be, in a length of 1 mile of the berm, something like 68,000 tons of heavy mineral in relatively high-grade sand to a maximum depth of 10 ft. The western shores of this narrow spit are covered by DLs 22 and 73 (Maryborough)—Crescent Rutile Ltd.

Test-boring by A. J. Campbell of banks in Tin Can Bay to the west of Inskip Point revealed no concentrations of possible commercial interest.

Authorities to Prospect, Noosa–Inskip

. .	Mineral Deposits Syndicate	Noosa–Double Island Point (beach)	1949
22M	Australasian Oil Exploration Ltd.	Noosa–Double Island Point (dunes)	1956–57
39M	Titanium Alloy Manufacturing Co. Pty. Ltd.	Inskip Peninsula Upper Noosa Valley	1955–62
66M	E. T. Johns . .	Lake Cooroibah . .	1956
103M	A. J. Campbell . .	Tin Can Bay	1957–58

6. FRASER ISLAND

This island is essentially a vast mass of giant sand hills frequently showing north-westerly trends, and including in its central-east part consolidated sands of Teewah type. (Connah 1948). Rock outcrops are restricted to the andesite of Indian Head, Middle Rock and Waddy Point. Over a length of twenty miles at the southern end there is a lowland accretion in which several old strand-lines are preserved alternating with swampy areas, and fringed on the east by newer coastal dunes of both parallel and transgressive types. Around Indian Head and northwards towards Sandy Cape active transgressive dunes extend inland from the beach up to ½ mile, overriding the older vegetated ones. Blow-outs engulfing large areas of the giant dunes and now disconnected from the coastal dunes are a feature of the northern half of the island.

With the exception of the areas of coastal dunes referred to, the beach is backed by giant dunes. Sandrock and peaty shale occur at numerous places along the beach, notably Poyungan and Yidney Rocks, and may become completely covered during periods of beach build-up. On the western side of the island areas of low parallel dunes occur at Rooney and Sandy Points, at the exposed extremities of Platypus Bay. Elsewhere the western coast comprises truncated giant dunes with or without swampy fringes.

Eastern Beach and Coastal Dunes.—Considerable reconnaissance and open-grid drilling covering much of the east coast has been carried out by Mineral Deposits Syndicate (1949-50 and 1954-56) and by TAMCO (1953-57) and over smaller areas by a few other interests. Consolidated Zinc Pty. Ltd. examined the island in 1952 for possible commercial sources of ilmenite.

Black sand concentrations occur intermittently on the beach proper, more particularly adjacent to outcrops of sandrock. The concentrations are usually of small thickness and individual extent, but testing carried out by MDS in 1954-56 (DLs 7 and 8, Maryborough) and by F. W. Whitehouse in 1956 on behalf of Fraser Mineral Sands Syndicate (including DLs 5, 6, 15 and 16) over 30 miles of beach between Eurong Road and Indian Head indicates that occasionally deposits aggregating several feet thick and of moderate overall grade may form in substantial quantity. No attempt has been made to assess total reserves in these sources, but they could be valuable at least for seasonal working as an adjunct to operations established in other coastal areas on the island. Twenty-five miles of the southern beach is held under lease by MDP (DLs 7-12).

Reconnaissance drilling by MDS in 1949-50 confirmed the general distribution of black sand deposits reported by Connah (1948) under shallow cover in the berm. The richest deposits, in seams carrying 15 to 85% heavy mineral, occur over a length of 4¾ miles south of Indian Head in the north (DL 3) and around North Spit in the south (DL 1), with smaller areas between Indian Head and Waddy Point (DL 4). Similar buried seams were also located in the berm between 3 and 7 miles north from North Spit (DL 2). At Indian Head seams up to 3½ ft thick lie at depths of 3 to 15 ft. The southern deposits are thinner, 6 to 30 in, at 6 to 14 ft depth.

Subsequent work by TAMCO by open-grid drilling (1955-57) has revealed a more extensive distribution of low-grade deposits (including buried seams) which with favourable markets may be suitable for dredging, in the berm and coastal dunes between 1 mile south and 8 miles north of North Spit, and in two smaller areas between Waddy Point and Sandy Cape in the far north. Average values in the areas delineated are very low in the North Spit area and somewhat higher in the Waddy Point–Sandy Cape deposits. Depths of sand range from 3 to 30 ft.

Average compositions of heavy minerals are:—

——	Zircon	Rutile	Ilmenite	Monazite	Others
	%	%	%	%	%
North Spit—DL1 (buried seams)	14	16	67	0·5	2·5
Beach, Eurong Road area—DL8	19	17	64	..	..
Indian Head South (buried seams)	21	19	57	0·5	2·5
Waddy Point—Sandy Cape	24	16	60	..	..

Over 100 miles of coastline from Wide Bay to Sandy Cape (including the Inskip Peninsula) TAMCO have proved the existence of about 1 million tons of heavy mineral in low- to very low-grade deposits, with average rutile content about 16%, zircon about the same and ilmenite about 60%. The overall grade of these deposits is less than ½% rutile in the ground.

In addition an unassessed substantial quantity of heavy mineral would be available on the beach as periodic storm deposits.

Southern Swamp Area.—Reconnaissance drilling has been carried out by TAMCO in this wide tapering belt in which several sand ridges apparently represent old strand lines. Values generally were very low, and the Company concluded that it is unlikely that any areas of workable grade and extent could be delineated. It seems that any beach concentrations that may have been formed in this belt have since been dispersed.

High Sand Hills.—The small amount of scout testing so far done has failed to reveal any more than traces of heavy mineral in these very extensive areas of sand and in the watercourses draining them. Though the coverage is quite inadequate to prove the whole area, the prospects of large wind-blown concentrations of Stradbroke type do not appear encouraging.

West Coast.—Thin skins of black sand have been observed at many places, more particularly about the mouths of creeks draining from the high sand hills, but no concentrations of possible commercial significance have been reported. Sandrock is exposed at many points. A reconnaissance of the west coast was made by O. A. Jones and D. G. Hughes for W. Rankin in 1950 and it was again examined by S. McKinnon for L. J. Williams in 1957. The average heavy mineral composition in a number of samples was:—

Zircon	39%
Rutile	7%
Ilmenite	54%

The sandy ridges at Sandy (Moon) and Rooney Points should be worth investigation for possible economic concentrations, though a low grade can be expected.

AUTHORITIES TO PROSPECT, FRASER ISLAND

..	A. G. Darling (MDS)	East coast 10 chain strip	1949–50
..	W. Rankin ..	Southern and western sides	1949–50
10M	Mineral Deposits Syndicate	Central Eastern coast	1954–56
39M	TAM Co.	Eastern side	1954
40M	Fraser Mineral Sands Syndicate	Central Eastern coast	1956–57
79M	L. J. Williams ..	Western coast ..	1957

7. BUNDABERG AREA

Between Point Vernon and Elliott Heads and again north of Burnett Heads flat sandy beaches are backed by vegetated dunes 10 to 15 ft high which give place westwards to low swampy land. Beach and dunes were reconnaissance-investigated by various interests in 1956-57. Most bores met mud, gravel, shell beds or indurated sand at depths of 5 to 15 ft, which, when penetrated, was underlain by barren sand.

Between Point Vernon and Elliott Heads nothing of interest was located except on W. M. B. Laycock's claims just south of Coonarr Creek, where over a length of ¾ mile irregular concentrations 3 to 8 ft thick of low-grade (2 to 9% heavies) occur beneath an average of 10 ft of dune sand. J. O. Cuthbert (see 67M) estimated that there are in this and the adjoining beach and berm, 8,000 tons of heavy mineral of composition:—

Zircon	13%
Rutile	10%
Ilmenite	75%
Others	2%

Bores sludged to 10 ft below low-water level in the Elliott estuary met no heavy mineral (49M).

Between Burnett Heads and Baffle Creek Mineral Deposits Pty. Ltd. by drilling on lines about 1 mile apart found only scattered low-grade concentrations —up to 7% but generally less than 3%—in the berm and dunes. This does not eliminate the possibility of scattered small richer concentrations.

AUTHORITIES TO PROSPECT, BUNDABERG AREA

15M	Mineral Deposits Pty.	North from Burnett Heads	1955–57
21M	Rutile Sands Pty.	Burrum Point—Woodgate	1956
49M	W. J. Gourley ..	Point Vernon—Burnett River	1956
67M	Barns Rutile Syndicate (F. C. Ker)	Theodolite Creek—Coonarr River	1956–57

CENTRAL QUEENSLAND

8. PORT CURTIS DISTRICT

(a) Baffle Creek–Rodd's Peninsula

Sandy beaches extend between rocky headlands and are backed by dunes which on the Round Hill peninsula are up to 60 ft high and extend inland for 30 chains. The area was investigated in reconnaissance by Mineral Deposits Pty. in 1956-57. Many bores met mud, gravel or bedrock at shallow depths (5-25 ft). By hand augering and sludging on lines ½ mile to 1 mile apart, widespread evidence of heavy mineral concentration was found, more particularly in the dunes, with little concentration of any significance on the beaches. Having regard to the situation of the area, the Company considered that deposits of sufficient size to be of commercial interest are limited to three distinct areas to the south of Wreck Rock, and to the south and west of Round Hill Head (Seventeen Seventy) respectively, over which dredging leases Nos. 5 to 9 (Gladstone) were applied for.

Within the three separate areas so delineated in a length of 25 miles of coast total reserves of nearly 1 million tons of heavy mineral were estimated at grades of from 5 to 9% heavy mineral, subject to confirmation by detailed boring. Heavy mineral composition was determined as:—

Zircon ..	2·4— 5·6%
Rutile ..	1·4— 4·0%
Ilmenite ..	91·1—94·6%

The electromagnetic ilmenite fraction is low in chromic oxide, six determinations ranging from 0·09% to 0·17% Cr_2O_3.

AUTHORITY TO PROSPECT

15M	Mineral Deposits Pty. ..	1955–57

(b) Boyne River Area

Sandy beaches and adjoining low dunes on Wild Cattle Island, Tannum Sands and Boyne Island were reconnaissance drilled by Rutile Sands Pty. in 1956 and some further testing was done by H. Urquhart in 1957. On Wild Cattle and Boyne Islands holes at high-water mark met no heavy mineral to water level (5 ft), except in traces towards the northern end. On Tannum Beach, for 1½ miles south of Canoe Point bores at high-water mark revealed thicknesses of sand from 6 in to 4 ft containing 5 to 40% heavy mineral, beneath 0 to 4 ft of barren sand and resting on rock. Scout bores in the dunes showed no heavy mineral. A grain count of a combined sample of heavy mineral from Tannum gave:—

Zircon	20%
Rutile	5%
Ilmenite	70%
Others	5%

Reserves in the area thus appear to be unimportant.

AUTHORITIES TO PROSPECT, BOYNE RIVER AREA

18M	Pacific Uranium and Oil Syndicate	1955–56
34M	Rutile Sands Pty.	1956
83M	H. Urquhart—South of Boyne River	1957–58

(c) Facing Island

The island was investigated by The Zinc Corporation Ltd. in 1952. It was shown to consist of a thin cover of sand over rock, which outcrops at frequent intervals along the eastern coast, with intervening short sandy beaches backed by low dunes. Widespread small concentrations of heavy mineral were found on the beach and drilling revealed low-grade concentrations (generally less than 3%) in the shallow dunes (3 to 16 ft), but no worthwhile deposits were indicated. Heavy mineral in the southern part of the island contained:—

—	Dunes	Beach
	%	%
Zircon	5·9	7·9
Rutile	0·6	0·8
Ilmenite	91·7	86·7
Others	1·8	4·6

Vegetated dunes further inland were not tested, but there seems no reason to expect any better prospects in them.

(d) Curtis Island

More than half the east coast consists of rocky cliffs and headlands, but at the southern and northern ends sandy beaches and coastal dunes extend over lengths of a few miles. The dunes have their greatest development at the northern end, to form the Cape Capricorn Peninsula, where, with north-west trends, they rise to heights of 200 to 250 ft. This area is therefore of greatest interest. There is also a fringe of low dunes on the northern coast.

The island was investigated by reconnaissance boring by The Zinc Corporation Ltd. in 1948 and again in 1952, and later in somewhat greater detail by Cardno and Davies for Rutile Sands Pty. in 1956-57.

Small rich concentrations were found on the beach and berm for some 6 miles south of Cape Capricorn, and it was estimated by Cardno and Davies that these transient deposits contain a total of some 26,000 cu yd of heavy mineral at an average grade of about 15%. Composition based on two samples by Rutile Sands Pty. is approximately:—

Zircon	18·5%
Rutile	4·0%
Ilmenite	73·5%
Others	4·0%

The Cape Capricorn dunes were found to be underlain by bedrock at no great depth below beach level. Grid drilling by Cardno and Davies indicated within an eastern 600 ft width for 5½ miles south from Cape Capricorn values to depths of 10 to 30 ft

nowhere greater than 4% and averaging 1% or less heavy mineral. Further west and at greater depth values deteriorated still more. Heavy mineral composition was given as:—

Zircon . .	. . 15·6%
Rutile . .	. . 2·5%
Ilmenite . .	. . 78·0%
Others . .	. . 3·9%

The beaches and dunes further south were found to be virtually devoid of heavy mineral.

By far the best prospects lie in a bare area of 35 acres or more of wind-blown sand up to 125 ft high—the Yellow Patch—at the north-west end of a large wind-formed depression on the west side of Cape Capricorn Peninsula. Fifteen holes sunk by Zinc Corporation on a grid pattern to depths up to 30 ft indicated a fairly consistent grade of 3·3% heavy mineral. The volume of sand to high-water level was estimated at 3·4 million cu yd but deeper testing would be required to determine average grade to that depth. Average heavy mineral composition of five bulk samples was:—

Zircon . .	. . 13·0%
Rutile . .	. . 8·6%
Ilmenite . .	. . 76·5%
Others . .	. . 1·9%

One analysis of an ilmenite fraction showed less than 0·08% Cr_2O_3. DL app. 1 (Gladstone)—Mineral Deposits Pty.—covers the Yellow Patch.

On the north side of the island scout boring by Cardno and Davies revealed values much less than 1% in the low dunes. Drilling by G. F. Hansen of the extensive sand and mud banks between tides indicated little heavy mineral except on a low sandy island opposite the Yellow Patch, in which there were indicated to be medium-grade concentrations of possible commercial interest with average "heavy" composition:—

Zircon . .	. . 13%
Rutile . .	. . 3%
Ilmenite . .	. . 83%
Others . .	. . . . 1%

A sample of separated ilmenite assayed 0·12% Cr_2O_3. DL 11 (Gladstone) was applied for by G. F. Hansen covering this deposit.

AUTHORITIES TO PROSPECT, CURTIS ISLAND

24M	Rutile Sands Pty.	1956–57
31M	G. F. Hansen—C. Capricorn—C. Keppel	1956

9. ROCKHAMPTON DISTRICT

(Keppel Bay–Cape Townshend)

Black sand has been reported over some 3 miles of beach north of Cattle Point at the mouth of the Fitzroy River. Heavy mineral composition in a sample submitted by J. Pilkington in 1956 was:—

Zircon . .	. . 9%
Rutile . .	. . 9%
Ilmenite . .	. . 63%
Magnetite . .	. . 12%
Others . .	. . 7%

The deposit has not been investigated, but obviously is only small.

The coast between Keppel Bay and Waterpark Point was investigated by Dowsett Engineering (Aust.) Pty. Ltd. in 1954, who recorded only small beach concentrations at Keppel Sands, Oaks, Statue and Yeppoon Beaches and at Waterpark Point. The total quantities are not large and rutile content of the heavies was given as 4 to 5%, with 10 to 30% zircon.

The beaches alternating with rocky cliffs and headlands between Yeppoon and Port Clinton are backed by dunes up to 20 ft high and culminating in heights of 150 ft near Cape Clinton. They were investigated by Mineral Deposits Pty. in 1955-56, who, from reconnaissance hand-boring and sludging, reported substantial deposits at the top of the beach between Waterpark Point and Cape Clinton in addition to low-grade deposits in the dunes up to 3 chains inland at the northern and southern ends. The beach concentrations are rich in many places. Within five separate areas the Company estimated total reserves of about ¼ million tons of heavy mineral at grades of from 4 to 50%, subject to confirmation by detailed boring. Heavy mineral composition was determined as:—

Zircon . .	. . 10·4–16·2%
Rutile . .	. . 5·4–10·0%
Ilmenite . .	. . 75·3–81·6%

The electromagnetic ilmenite fraction is fairly low in chrome, four determinations showing about 0·25% Cr_2O_3.

DL applications 6-10 (Rockhampton), in the name of Mineral Deposits Pty., cover these deposits.

The Pearl Bay area, to the north of Port Clinton was visited by Rutile Sands Pty. in 1956, who reported small black sand seams at the top of the beach, but overall grade was indicated to be only about 3% heavy mineral. The Company did not proceed with further investigation. The beach is backed by high dunes (up to 200 ft).

Samples of black sand from Townshend Island were forwarded by Mr. D. L. Fraser in 1956. No details are available of the deposit which is presumably small. The heavy mineral contained about 20% zircon and 2% rutile, the remainder being principally magnetite and ilmenite.

AUTHORITIES TO PROSPECT, KEPPEL BAY–CAPE TOWNSHEND

16M	Mineral Deposits Pty.	..	1955–56
35M	Rutile Sands Pty. ..	Pearl Bay	1956
89M	Rutile Sands Pty. ..	Pearl Bay .. .. (no work done)	1957

10. BROADSOUND

Beach washings and covered seams in "reasonably large deposits" were reported by Dowsett Engineering (Aust.) Pty. Ltd. in 1955 on Freshwater Bay and One Mile Beach between Clairview and Carmila. Rutile content of the heavy mineral was given as 3½% and zircon 18%. The deposits have not been investigated further. On other beaches northwards from Clairview to Mackay no evidence of black sand was found.

11. MACKAY DISTRICT

(Carmila–Proserpine)

This section of the coast is characterized by numerous rocky headlands and extensive swamp fringes in the sheltered portions. Between these there are frequent short sandy beaches, the greatest sand accumulations being in the Mackay area. The beaches were examined by Dowsett Engineering (Aust) Pty. Ltd. in 1955, who found no evidence of appreciable heavy mineral concentration except in the Shoal Point–Bucasia area some 10 miles north of Mackay.

This area was investigated in 1956 by Tweed Rutile and Minerals Ltd., and it is reported that many bores were sunk. Detailed results are not recorded in the Department, but it is known that their conclusions were unfavourable as to overall grade and the feasibility of economic exploitation.

Rich black sand concentrations occur in a narrow strip at the top of the beach for about 1 mile south from Shoal Point and at the end of the Spit to the west. Examination by the writer in 1958 revealed thicknesses of from 5 to 24 in at high water mark tapering seawards, and carrying 50 to 90% heavy mineral. Reserves of about 10,000 tons of heavy mineral are indicated, of a composition approximately:—

Zircon	7%
Rutile	trace
Ilmenite	40%
Magnetite	52%
Others	1%

Ilmenite separated electromagnetically assayed 0·02% Cr_2O_3 and 46·6% TiO_2.

This beach is backed by a substantial belt of vegetated dunes up to 30 ft high, with a westerly extension along the spit. It is not known if they have been conclusively tested by drilling but a few bores sunk independently by M. E. Low in 1956 and R. H. Simons in 1957 showed less than 1% heavies in the top 5 ft.

Beach resources alone do not appear to be sufficient as a basis for a local industry.

Black sand of similar composition (zircon 3%) is reported from Cannonvale Beach near Proserpine. Presumably it is a very small deposit.

AUTHORITY TO PROSPECT, MACKAY

52M	Tweed Rutile and Minerals Ltd. ..	1956–57

12. BOWEN DISTRICT

Black sand forms at times on the beaches about Bowen, but no accumulations of any significance have been reported. Some wind concentration of heavy mineral is reported in the top 2 ft of dunes behind King's Beach (samples from H. C. Daniel 1956). The dunes have not been tested in depth. However they are neither large nor extensive, and the heavy mineral consists essentially of ilmenite and magnetite. A typical composition is:—

Zircon	trace
Rutile	—
Ilmenite	83%
Magnetite	16%
Others	1%

Slight concentrations have been observed on tidal banks behind Queen's Beach and about the mouths of Don River and Euri Creek, but the deposits are not of commercial interest.

AUTHORITY TO PROSPECT :

61M	C. D. McIntosh ..	(no work)	1956–57

NORTH QUEENSLAND

13. AYR DISTRICT

Black sand has been reported at Lynch's Beach, Alva, 10 miles north of Ayr, but nothing is known of its thickness or extent. It is presumably beach washing (sample from G. R. Wilson who held former DL apps. 2 & 3, Townsville). A typical grain count of the Alva heavy mineral is:—

Zircon	5%
Rutile	0·3%
Ilmenite	69%
Magnetite	23%
Others	2·7%

Similar sand was also reported from other parts of the foreshores of Upstart Bay. Samples from dunes in the same area contained less than 1% heavy mineral.

14. TOWNSVILLE DISTRICT

Thin black sand washings have been noted at several places along the beaches about Townsville, Halifax Bay, and on Magnetic Island, but no deposits of significance are known. Heavy mineral composition

at the mouth of Wild Boar Creek near Rollingstone is typical:—

Zircon	5·0%
Rutile	trace
Ilmenite	83·6%
Magnetite	10%
Others	1·4%

Electromagnetically separated ilmenite from the area assayed 0·01% Cr_2O_3.

Dowsett Engineering (Aust) reported a very low percentage of heavy mineral throughout the dunes on Rita Island and on Clevedon Beach, but no indication of any appreciable deposit.

AUTHORITY TO PROSPECT

113M	J. Stevens ..	Black River—Crystal Creek	1957

15. HINCHINBROOK ISLAND

Heavy black sand concentrations occur on the shores of Ramsay Bay at the northern end. The beach is backed by dunes up to 30 ft high. Test boring of the southern 2 miles of this beach, where apparently the principal concentrations were located, was carried out for W. C. Wilson in 1956–57, and included the frontal dunes to depths of 12 ft. Details of results are unknown. The area was abandoned when it was established that the proportions of zircon and rutile in the heavies were very low. Average composition was given as:—

Zircon	8·6%
Rutile	1·8%
Ilmenite	57·9%
Magnetite	5·5%
Hematite	5·9%
Others (silicates)	20·3%

Black sand is also reported along the shores of Mulligan Bay at the south end of the Island, but no particulars are available.

AUTHORITY TO PROSPECT

26M	W. C. Wilson ..	Ramsay Bay ..	1956–57

16. CARDWELL—CAIRNS

Sandy beaches backed by dunes occupy portions of this coast, but over much of it there are no appreciable sand accumulations. North from Palmer Point there is a long rocky stretch (granite).

Black sand from the beach on the south side of the Johnstone River mouth (Dunstan, 1905) consists largely of ilmenite with small amounts of zircon and accessories, and, possibly, a trace of tantalite. Subsequent investigation has indicated that the quantity is small.

An extensive corridor of sand on Cape Grafton Peninsula is made up of granite outwash (McKellar 1957a). Slight heavy mineral concentration occurs on the beaches and adjoining dunes, and these were covered by reconnaissance of the whole coastline by various interests in 1956–57. Reports indicate that no areas of possibly workable grade and extent were located. Average values to water level on Oombunghi and King Beaches near Cape Grafton—the most promising areas—were reported by McKellar to be less than 0·2% heavy mineral.

Composition of the Oombunghi concentrate was:—

Zircon	20·4%
Rutile	3·2%
Magnetics	75·1%
Others	1·2%

AUTHORITIES TO PROSPECT

..	Dowsett Engineering (Aust.) Pty. Ltd.	..	1954
38M	C. S. Hart ..	Mourilyan – Cooper Point	1956
55M	C. D. McIntosh ..	Tam O'Shanter Point–Mourilyan	1956–57
56M	T. H. Hardy ..	Rocky Point–Bramston Point	1956–57
85M	Associated Minerals Consolidated	Palmer Point–Mission Bay	1957

17. CAPE YORK PENINSULA

East Coast

Practically the whole coastline has been covered by Authorities to Prospect, on reports of which the following particulars are essentially based.

Between Cairns and Cooktown the coastline is generally rugged, with an absence of wide sweeps of sandy beach suitable for heavy mineral accumulation in quantity. Even on the short beaches that do exist, there is no appreciable heavy mineral.

Northwards from Cooktown there is a recurrence of broad sweeping bays and small sandy beaches between rocky headlands, with swamp fringes in sheltered portions. The only long stretches of sandy beach are on the western shore of Princess Charlotte Bay and in Shelburne Bay. The beaches are often backed by dunes rising to heights up to 30 ft and sometimes extending inland upwards of ¼ mile, resting on a shallow rock basement. Beach profiles are flat. There is little evidence of large scale longitudinal drift of sand, and major parallel dune patterns are noticeably absent. In general there is a lack of the conditions requisite for concentration of heavy minerals on a substantial scale.

Small surface concentrations of black sand occur on many beaches, but extensive drilling, by various companies, of both beaches and dunes revealed that with few exceptions average values to depths of even a few feet are generally less than 1% heavies. The only appreciable concentrations of any size reported are at Double Point and to the south of Red Cliffs in Shelburne Bay, and on Turtle Head Island. Even these are narrow beach-top strips less than a mile in length and a foot or two in depth, with average heavy mineral content of 10 to 15%, and are not considered to be large enough to be developed profitably in the foreseeable future.

A characteristic of these Peninsula occurrences is considerable variation in heavy mineral ratios, indicating derivation from essentially local sources. A few examples are:—

——	Zircon	Rutile	Ilmenite	Magnetite	Others*
	%	%	%	%	%
Princess Charlotte Bay	0·9	1·4	61·6	2·2	33·9
Lloyd Bay ..	23·1	3·6	59·5	4·0	9·8
Shelburne Bay ..	30	53·5	2·0	..	14·5
Turtle Head Island	60	20	15	..	5

* Mainly silicates, but including up to 1% monazite.

One small concentration at the northern end of Shelburne Bay carried 80% garnet.

AUTHORITIES TO PROSPECT

..	Dowsett Engineering (Aust.) Pty. Ltd.	..	1954
25M	Mineral Deposits Pty.	Olive River–Fly Point	1956
33M	A.O.E.	C. Melville–C. Weymouth	1956
36M	Tweed Rutile and Minerals Ltd.	Cooktown — C. Melville	1956
50M	T. J. Higgins ..	C. Weymouth–Olive River	1956–57

West Coast

The geological features of the western Peninsula have been described by Evans (1959) and McKellar (1957b). North from Archer Bay cliff sections (bauxitic material and lateritized sediments mainly) are common, but between them are areas of sand dunes, probably 15 to 20 ft high, which in the section between the Jardine and Pennefather Rivers extend up to 3 miles inland. Between the Archer and Norman Rivers, however, the coastal sector consists largely of clay pans and swampy flats from which rise a parallel series of low sand dunes, apparently representing old strand lines. Similar parallel dune and trough systems separated by miles of flat salt pans have been noted up to 20 miles inland (McKellar 1957b). Beach profiles are flat, and the sand contains much shelly material.

The whole of the coast north from Karumba has been investigated in reconnaissance by Australian Mining and Smelting Co. Ltd., and Associated Minerals Consolidated Ltd. examined the beaches, dunes and mud flats south of Cape Keerweer. In the early stages A.M. & S. employed a helicopter-mounted scintillometer with some success to locate heavy mineral concentrations carrying a small proportion of monazite.

Results have confirmed that south from Archer Bay, although quantities of heavy mineral are undoubtedly brought down by the rivers, there is an absence of the mechanism necessary to effect significant concentration. Except for occasional rich thin skins of small extent, average heavy mineral values throughout this section are little more than traces, and nowhere more than 0·2%.

Northwards from Archer Bay wave action appears to be somewhat greater, and slight concentrations were found at many places between there and Vrilya Point. Average values, however, were found nearly everywhere to be very low in both beach and dunes. Australian Mining and Smelting Co. Ltd. report that concentrations of appreciable grade and extent were located only about Urquhart Point in Albatross Bay and near False Pera Head.

At Urquhart Point the deposit occurs principally to the east of the point in a sheltered erosion embayment in Pleistocene shelly sandstones. It is of particular interest in that the main concentration consists of a quite high grade mass of sand forming dunes rising to 10 to 15 ft above sea level, without any cover or interbedding of low grade sand. Heavy mineral content ranges up to 70% or more over sections of from 2 to 9 ft, and averages 32%. Lower grade deposits occur in the coastal dunes west of the Point. The heavy minerals contain an average of 25% rutile and 28% zircon with very little ilmenite. Grab samples have shown up to 56% rutile, 55% zircon and 9% monazite.

At Urquhart Point, A.M. & S. Co. has estimated by drilling at least 8,000 tons of rutile and a comparable amount of zircon in some 300,000 tons of sand; the greater part of these reserves being in the high grade deposit referred to above.

The formation of deposits of this type obviously requires very different conditions from the intermittent concentrations of the East Coast, as noted earlier (p. 4).

The deposits near False Pera Head have not been investigated in detail.

A notable feature of the west coast is the variability of heavy mineral composition, reflecting absence of drift. Some typical grain counts are:—

——	Zircon	Rutile	Ilmenite	Others
	%	%	%	%
Smithburne River ..	8·3	1·5	72·9	17·3
Topsy Creek (near Mitchell River mission)	14·6	1·3	77·9	6·2
False Pera Head ..	36	37	19	8
Urquhart Point (dunes) ..	28	25	small	47
*Pennefather River ..	14·2	27·6	48·9	9·3
*Port Musgrave	54·7	11·9	20·7	12·7
*Vrilya Point	12·7	7·4	73·8	6·1

* Grab samples.

AUTHORITIES TO PROSPECT

28M	Australian Mining and Smelting Co. Ltd.	Weipa area ..	1956–59
37M	Australian Mining and Smelting Co. Ltd.	West coast ..	1956–58
106M	Associated Minerals Consolidated Ltd.	South from Cape Keerweer	1957
143M	Australian Mining and Smelting Co. Ltd.	Weipa–Pera Head	1959–60

(c) Islands

Black sand has been noted on beaches of some of the Islands adjoining the Peninsula. The deposits have not been inspected, but it is presumed that they are not extensive. The following counts of heavy mineral composition are recorded:—

	Zircon	Rutile	Ilmenite	Others
	%	%	%	%
Prince of Wales Island	65	tr	24	11 (Magnetite 5)
Mornington Island	15·0	2·9	71·8	10·3 (Magnetite 8·3)

(d) Cape York

Coastal sands near Cape York Telegraph Station carry patchy tin concentrations. Investigation by Mineral Deposits Pty. Ltd. in 1956–57 indicated that the concentrations were of small dimensions, and bore intersections suggested average values, to depths of from 4 to 14 ft, of from 0·3 to 1 lb. black tin per cu. yard. The deposits appear to have little commercial interest.

AUTHORITY TO PROSPECT

57M	Mineral Deposits Pty. Ltd.	Cape York	1956–57

OFF-SHORE AREAS

During the rutile "boom" of 1956-57 interest arose in testing the off-shore sea bed for possible heavy mineral concentrations of potential value, and several Authorities to Prospect were granted over such areas between Coolangatta and Sandy Cape. Great difficulties were experienced in attempting to devise suitable equipment, and the search was soon abandoned in some areas. In the Coolangatta–Southport area and in Laguna Bay, however, a limited amount of boring was achieved. In the former case, Ocean Minerals Ltd. using an Amphibian Duck, made over fifty tests to depths of 15 ft of sand in waters up to 60 ft deep, and in the latter Titanium Corporation of Australia Pty. Ltd. sank six holes to depths up to 7 ft below the sea bed in up to 35 ft of water. A few bores were sunk by Ipswich Minerals Pty. Ltd. to depths of 4 to 9 ft in the banks off Brisbie Island. No more than traces of heavy mineral were recorded in the samples recovered. In view of the disappointing results and operational difficulties, all off-shore activity ceased when the rutile price collapsed.

AUTHORITIES TO PROSPECT

43M	Titanium Corporation of Australia Pty. Ltd.	Laguna Bay ..	1956–57
*54M	T. J. Higgins	Caloundra–Noosa	1956
71M	Billington and Bligh (Ocean Minerals Ltd.) ..	Point Danger–Cape Moreton	1956–57
75M	Ipswich Minerals Ltd. ..	Bribie Island—banks	1957
*76M	M. O. Guthrie	Double Island Point – Sandy Cape	1957
*93M	Pacific Enterprises Pty. Ltd.	Bribie Island ..	1957
*110M	L. S. Frost	Point Danger–Cape Moreton	1957

* No testing done.

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489 (1950) Chromite Concentration Products from Stradbroke Island Ilmenite. F. L. Stillwell.

509 (1952) Monazite Concentrates, Stradbroke Island. F. L. Stillwell.

527 (1953) Beach Sand Concentrates from Curtis Island. F. L. Stillwell.

543 (1953) Ilmenite Concentrate from T.A.Z.I. Pty. Ltd. A. B. Edwards.

690 (1957) Beach Sands from Hey River Estuary. G. Baker.

699 (1957) Beach Sand Products from Southport. G. Baker.

708 (1957) Tailings Sample from Beach Sands, Southport. G. Baker.

792 (1959) Less Susceptible Magnetic Fraction of the "Ilmenite" Product from Beach Sands, Stradbroke Island. G. Baker.

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291 (1945) Gravity Concentration of Zircon-Rutile bearing Sands from low grade deposits near Southport. J. G. Hart and H. H. Dunkin.

292 (1945) Electrostatic Separation of Zircon and Rutile from Gravity Concentrates produced from beach sands at North Burleigh. J. G. Hart and H. H. Dunkin.

337 (1949) Chromium in Ilmenite from Norries Head and Stradbroke Island.

339 (1949) Flotation of Zircon from beach sands from Southport. K. S. Blaskett and H. H. Dunkin.

350 (1949) Redressing of low grade Monazite Concentrate. K. S. Blaskett and H. H. Dunkin.

372 (1949-1950) Electrostatic Separation—1. Preliminary. 2. Zircon-Rutile Separation. S. B. Hudson.

383 (1950) Recovery of Zircon and Rutile from weakly magnetic minerals from Mineral Deposits Syndicate. S. B. Hudson and H. H. Dunkin.

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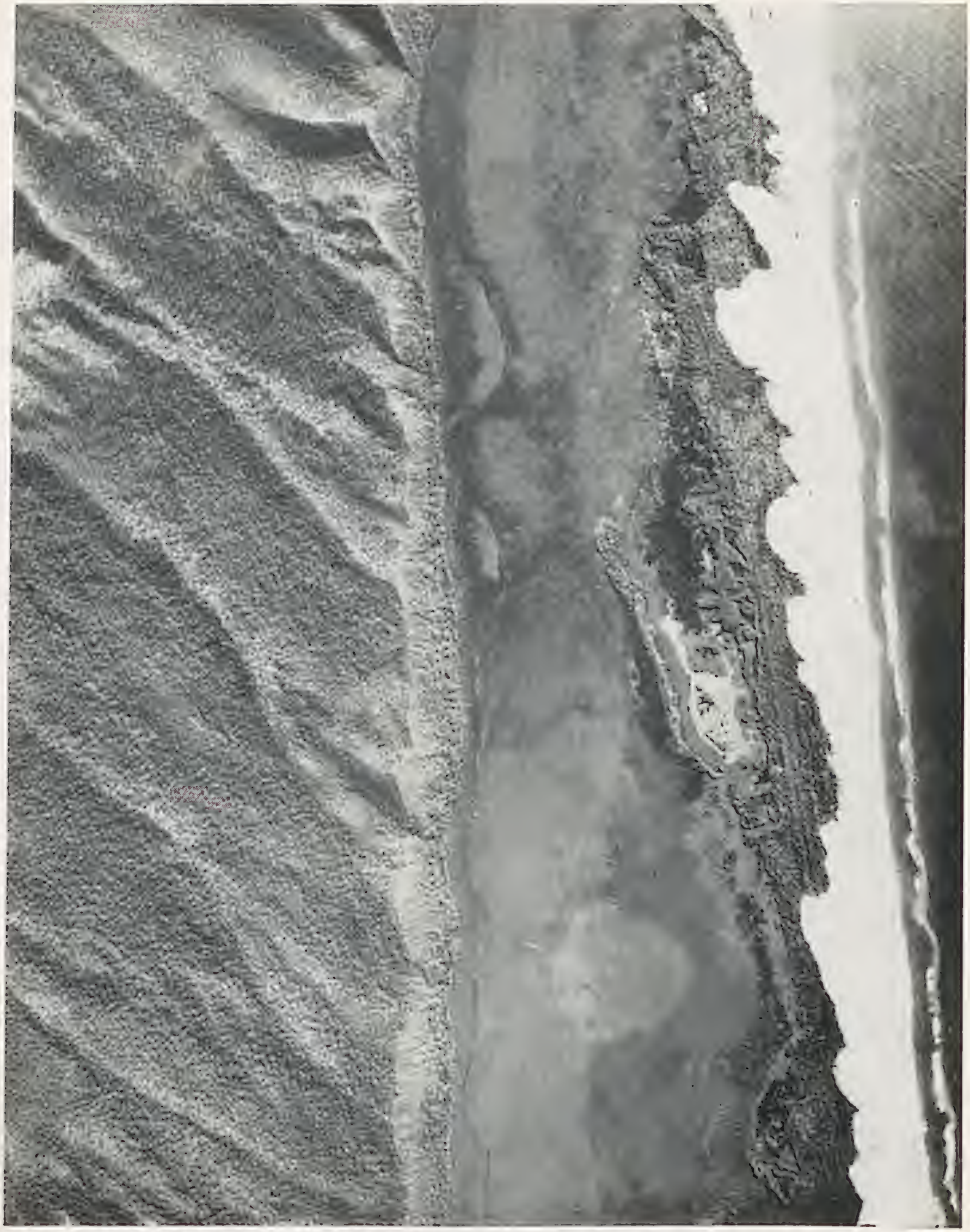


Plate 1

Aerial View, North Stradbroke Island, showing (from left) giant dunes, swamp, and vegetated parallel dunes being overriden by transgressive dunes. About 15 miles south of Point Lookout.

—Adastra Photo. 533–20, 1952—*Courtesy T.A.Z.I. Pty. Ltd.*

Plate 2

Aerial photo. mosaic, of southern end, Bribie Island, showing dune and sand ridge trends. Scale approx. 1 inch = 45 chains.

—State Photos.—Redcliffe area.

Plate 3

Aerial photo. mosaic of southern end of Fraser Island, showing giant dunes (left), swampy land (centre), and newer dunes on east coast (right). Scale approx. 1 in. = 40 chains.

—State Photos.—Wide Bay area.

Plate 4, Fig. A

View of Coastal Plain, North Stradbroke Island, looking south. Giant dunes at right, Eighteen Mile Swamp centre, coastal dunes on left, TAZI transport canal and ropeway foreground.

—Photo. T.H.C.

Plate 4, Fig. B

Exploration team taking sand samples by using sludge-pump.

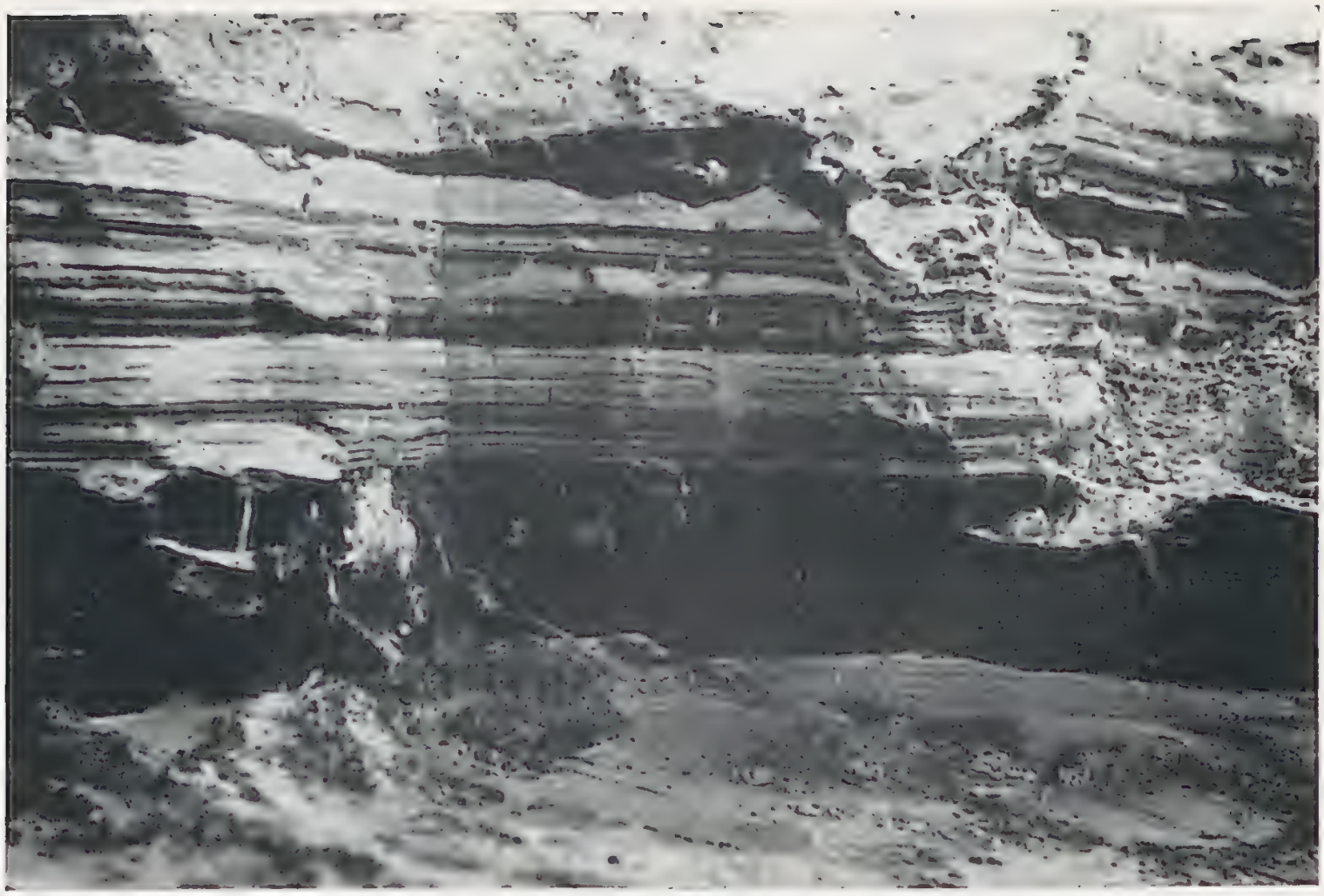


Plate 5, Fig. A
Rich black sand seams originally worked in dune areas Broadbeach.
—Photo. M.D.P. Ltd.

Plate 5, Fig. B
Hand-loading rich Beach Scrapings, North Stradbroke Island.
Photo. T.A.Z.I.

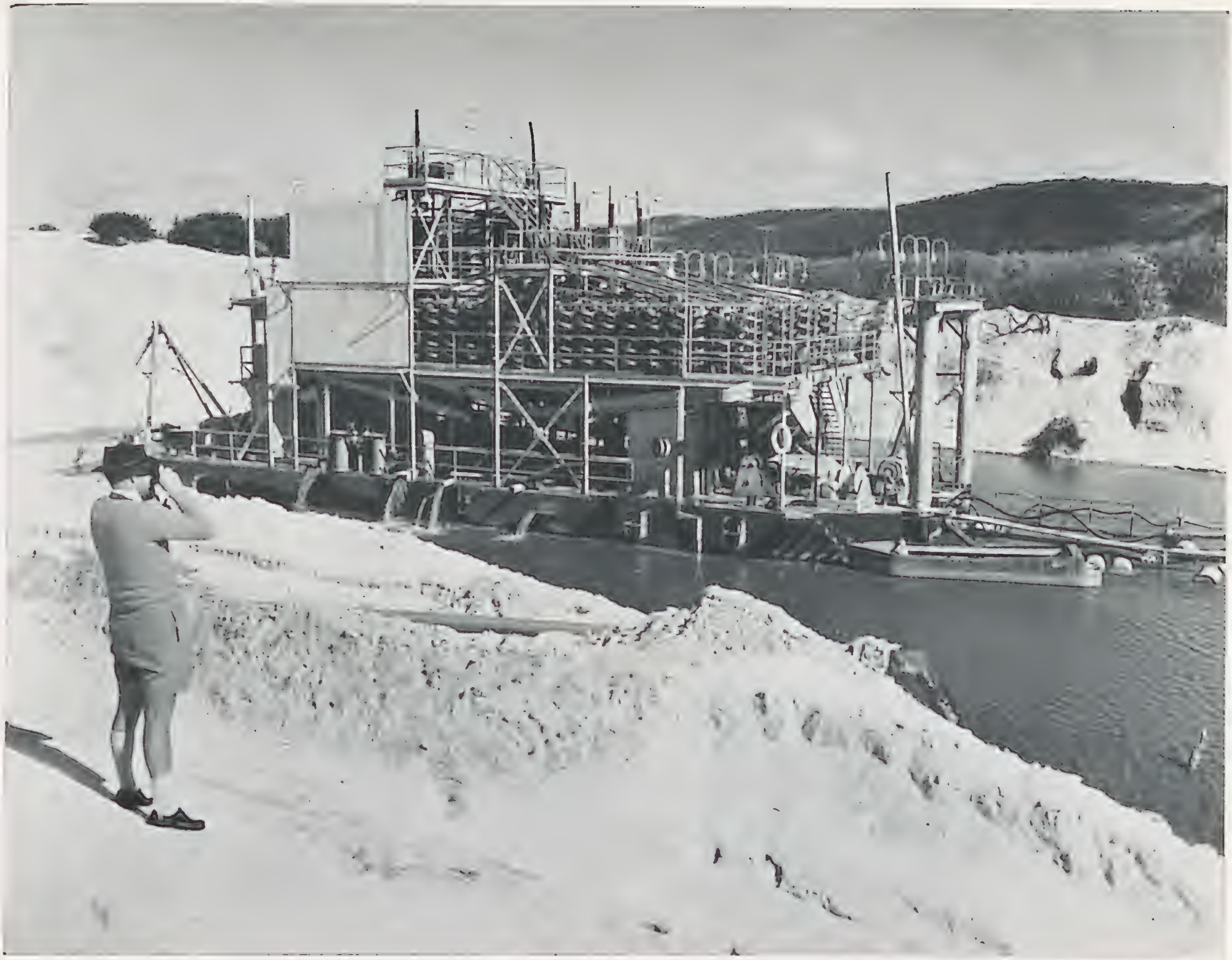


Plate 6

Dredge-mounted Spiral Unit at work on low grade deposits, North Stradbroke Island.

Plate 7, Fig. A

Oblique aerial view showing two operative dredge ponds in the east coast dunes, North Stradbroke Island. Eighteen Mile Swamp in foreground.

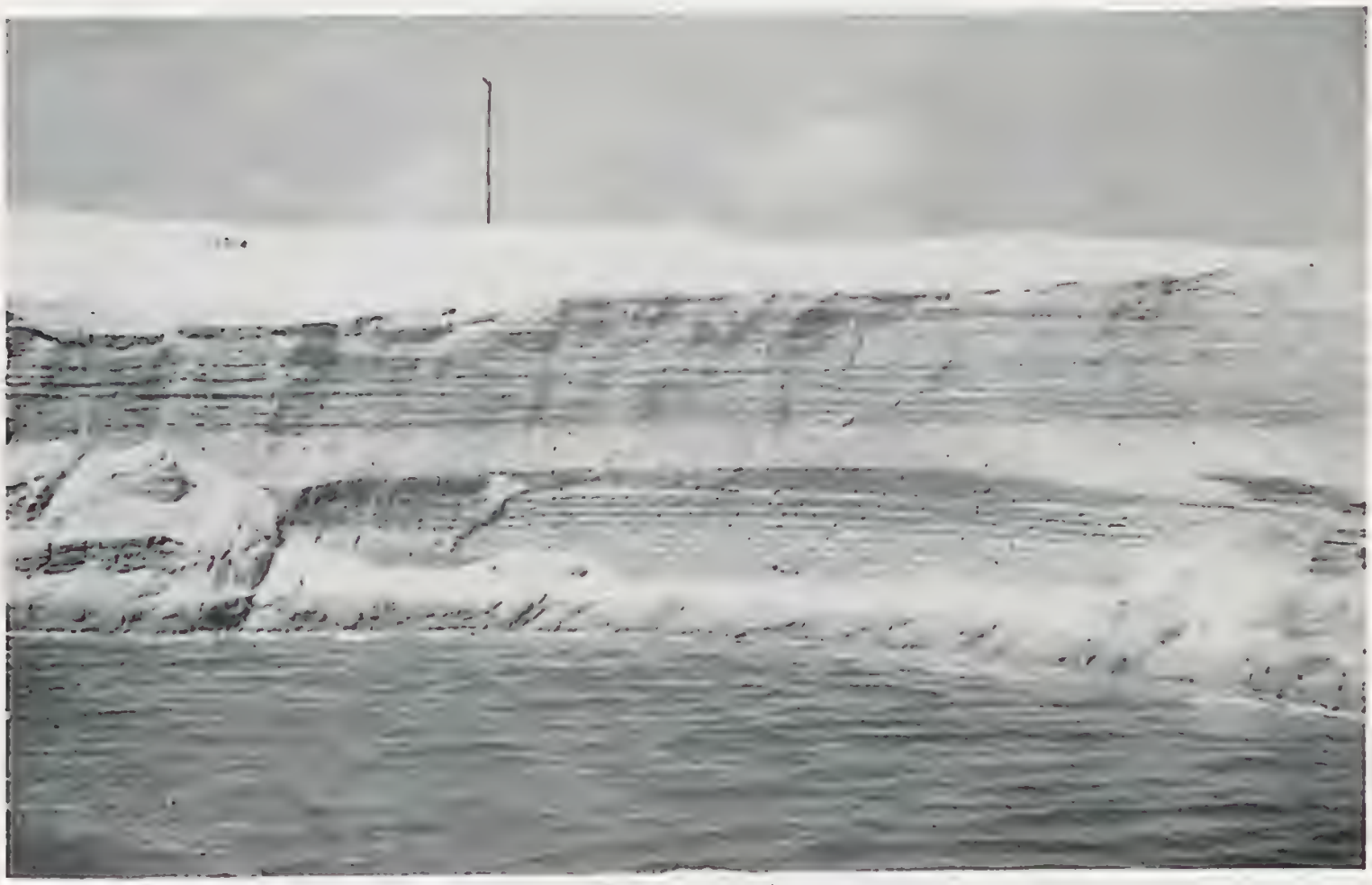


Plate 7, Fig. B

Black seams beneath dune sand, North Stradbroke Island.

—Photo. T.H.C.

Plate 8, Fig. A
Dredge Pond and Suction Dredge, Gold Coast.

—Photo. M.D.P. Ltd.

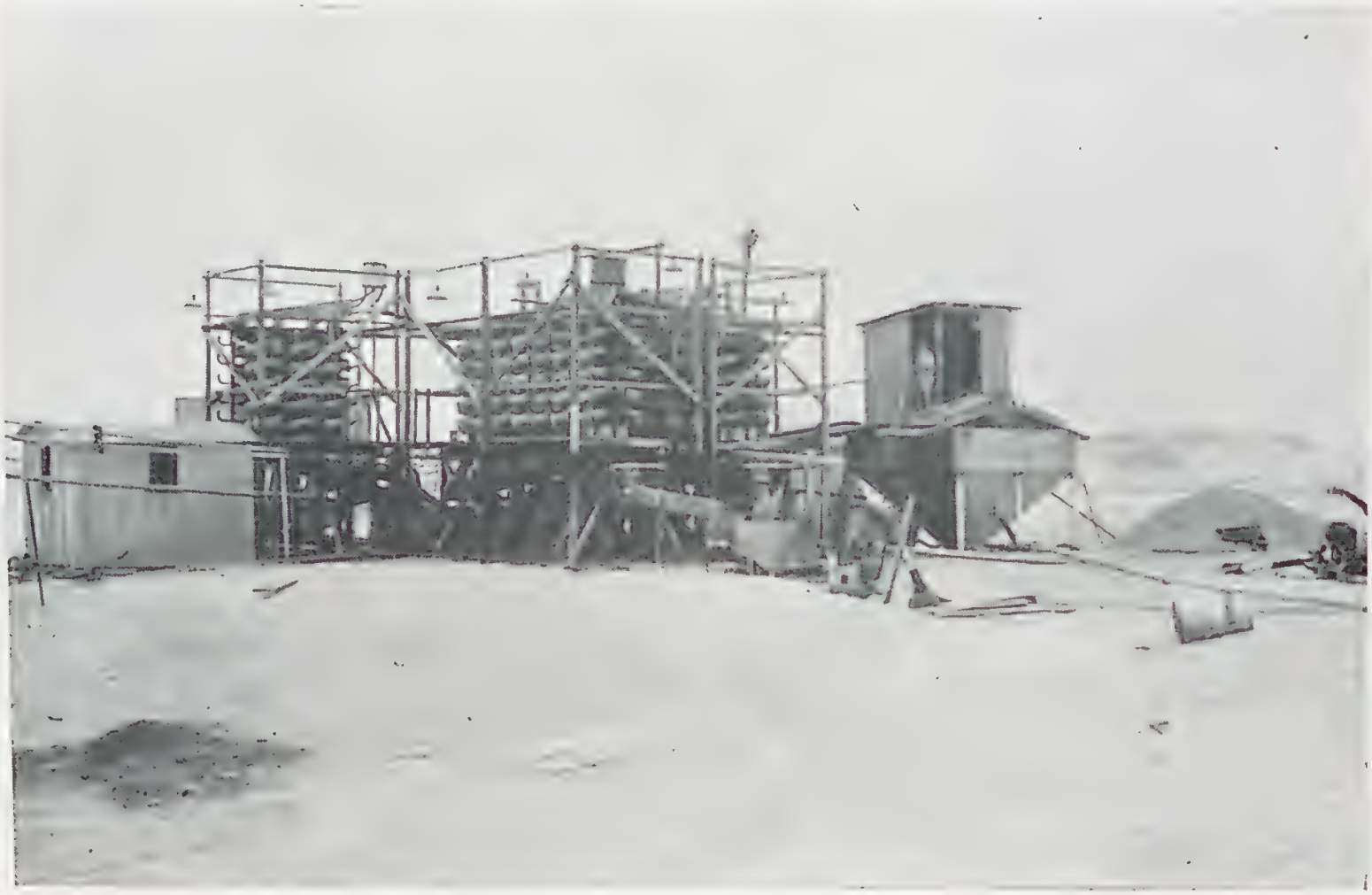


Plate 8, Fig. B
Portable Spiral Unit as used at Gold Coast by Mineral Deposits Pty. Ltd.

—Photo. T.H.C.

Plate 9, Fig. A

Oblique aerial view across North Stradbroke Island looking south-easterly from Dunwich township (foreground), showing road and aerial ropeway connecting Titanium and Zirconium Industries Pty. Ltd.'s treatment plant with the mining areas on the east coast (background).

Plate 9, Fig. B

Rehabilitation of dune area mined at Broadbeach. Taken in 1952.

Plate 10, Fig. A
Close-up view of Spirals.

Plate 10, Fig. B

Unloading Spiral Concentrate on to Ramp, whence it is pumped to Separation Mill, Mineral Deposits Pty. Ltd., Southport.

—Photo. M.D.P. Ltd.

Plate 11, Fig. A
Final table concentration of field spiral product, Mineral Deposits Pty. Ltd. mill, Southport.
—Photo. M.D.P. Ltd.

Plate 11, Fig. B
McLean Magnetic Separators.
—Photo. M.D.P. Ltd.

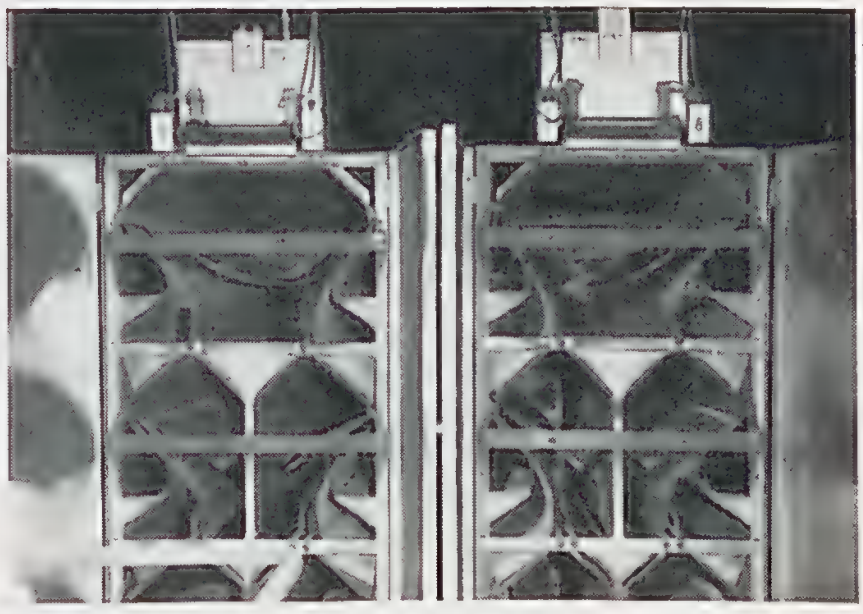


Plate 11, Fig. C
Reichert Electrostatic Separators.
—Photo. M.D.P. Ltd.

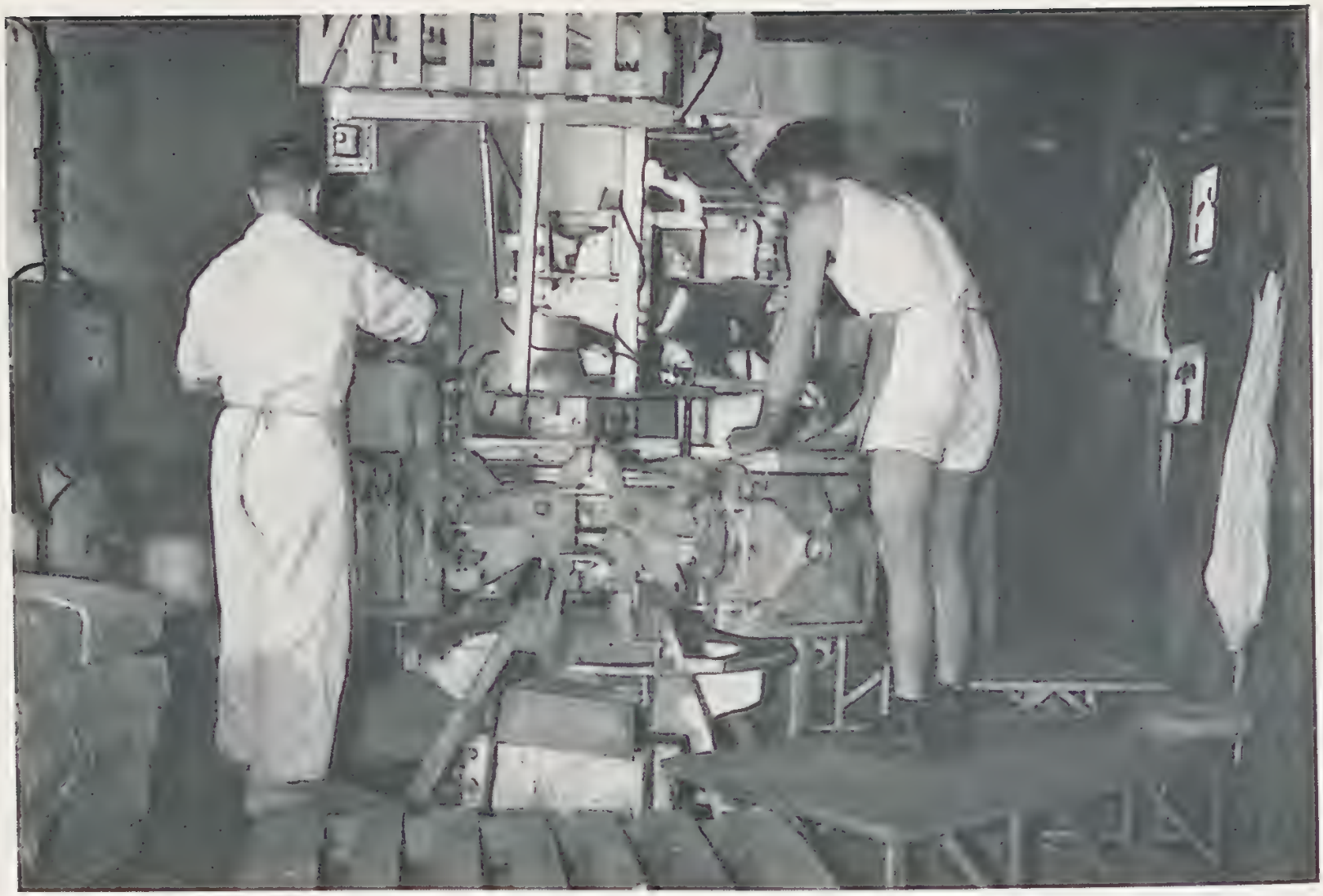


Plate 12, Fig. A
Bagging Machine.

—Photo. M.D.P. Ltd.

Plate 12, Fig. B
Loading Bagged Products on Lighter, Dunwich.

—Photo. Camera Craft Pty. Ltd.

FIG.1

Map of QUEENSLAND

To accompany a report on beach sand deposits by T. H. CONNAH, M.Sc., Senior Geologist

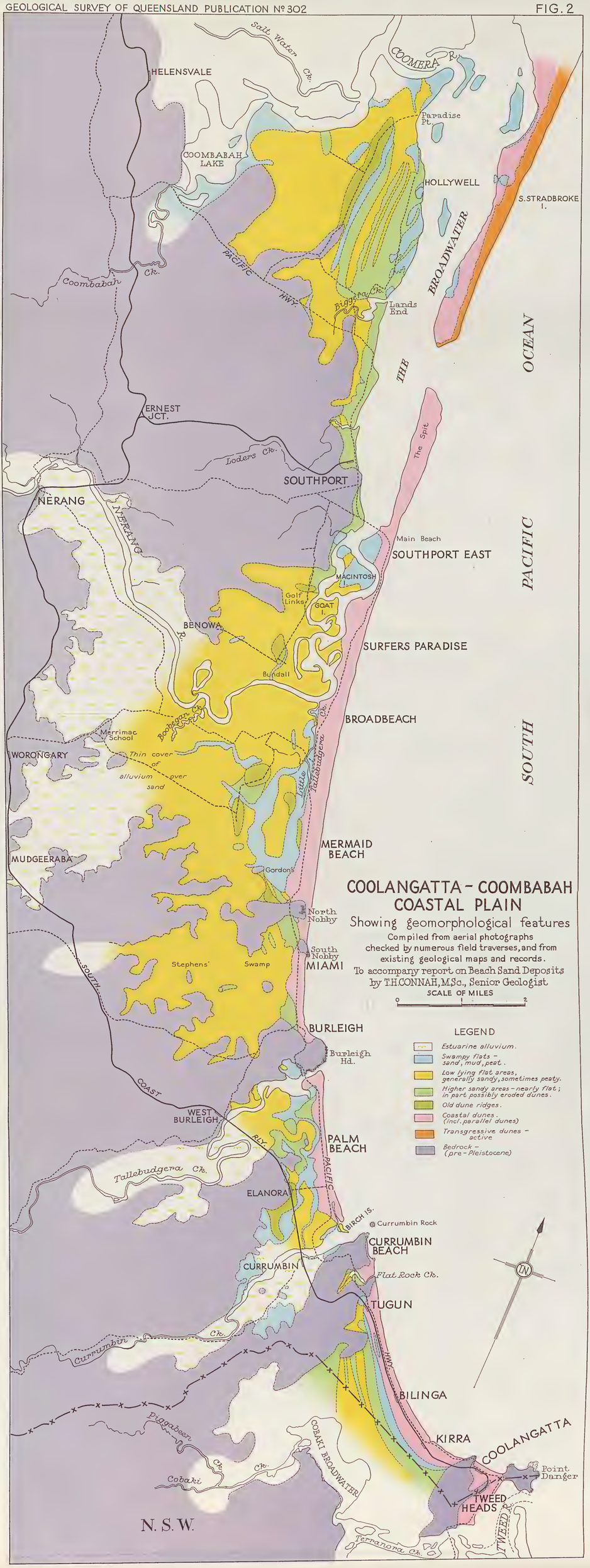
Scale of Miles

0 100 200 300 400 500 600

TORRES STRAIT
THURSDAY IS.
PRINCE OF WALES IS.
C. York
TURTLE HEAD IS.
Escape R.
Vrilya Pt.
Jardine R.
ORFORD BAY
SHELBURNE BAY
Red Cliffs
Double Pt.
C. Grenville
GULF OF CARPENTARIA
Wenlock R.
Pascoe R.
C. Weymouth
LLOYD BAY
ALBATROSS BAY
Weipa
Pera Hd.
False Pera Hd.
ARCHER BAY
Urquhart Pt.
Archer R.
C. Keerweer
PRINCESS CHARLOTTE BAY
C. Melville
GREAT DIVIDING RANGE
COOKTOWN
Mitchell R.
MORNINGTON IS.
CAIRNS
C. Grafton
Oombunghi Beach
Palmer Pt.
Cooper Pt.
Walsh R.
Gilbert R.
Einasleigh R.
Karumba
NORMANTON
INNISFAIL
Mourilyan
TULLY
CARDWELL
RAMSAY BAY
HINCHINBROOK IS.
MULLIGAN BAY
INGHAM
HALIFAX BAY
Norman R.
MAGNETIC IS.
TOWNSVILLE
Alva
AYR
UPSTART BAY
Burdekin R.
Euri Ck.
Don R.
BOWEN
Cannonvale
PROSERPINE
Cape R.
Shoal Pt.
MACKAY
Suttor R.
Belyando R.
Carmila
Clairview
Isaac R.
BROAD SOUND
TOWNSHEND IS.
PEARL BAY
C. Clinton
Waterpark Pt.
YEPPOON
KEPPEL BAY
C. Capricorn
CURTIS IS.
Mackenzie R.
Fitzroy R.
ROCKHAMPTON
RANGE
Dawson R.
GLADSTONE
FACING IS
Bustard Hd.
Boyne R.
Burnett Heads
Sandy C.
Indian Hd.
FRASER IS
BUNDABERG
MARYBOROUGH
Double Island Pt.
GYMPIE
Noosa Hd.
SEE INSET
BRIBIE IS
MORETON IS.
BRISBANE
STRADBROKE IS
SOUTHPORT
COOLANGATTA
C. Byron
YAMBA
Condamine R.
N. S. W.
SOUTH PACIFIC OCEAN

FACING IS
GLADSTONE
Tannum
Bustard Hd.
Boyne R.
Round Hill Hd.
Rocky Pt.
Wreck Rock
Baffle C.
Burnett Heads
BUNDABERG
Burnett R.
Elliott R.
HERVEY BAY
Coonarr C.
Woodgate
Vernon Pt.
Rooney Pt.
Sandy C.
Sandy Pt.
Waddy Pt.
Indian Hd.
FRASER ISLAND
Burrum R.
MARYBOROUGH
North Spit
Inskip Pt.
WIDE BAY
Double Island Pt.
Mary R.
GYMPIE
Noosa R.
Laguna Beach
Noosa Hd.
Paradise Caves
Mt. Perigian
Coolum
Pt. Arkwright
MAROOCHYDORE
Pt. Cartwright
CALOUNDRA
Brisbane R.
BRIBIE IS
C. Moreton
C. Cliff
Beachmere
MORETON
MORETON IS.
REDCLIFFE
BAY
BRISBANE
Pt. Lookout
N. STRADBROKE IS.
S STRADBROKE IS
SOUTHPORT
The Spit
BURLEIGH
COOLANGATTA
Pt. Danger
N.S.W.

INSET
Scale of Miles
0 50 100 150



COOLANGATTA - COOMBABAH COASTAL PLAIN

Showing geomorphological features

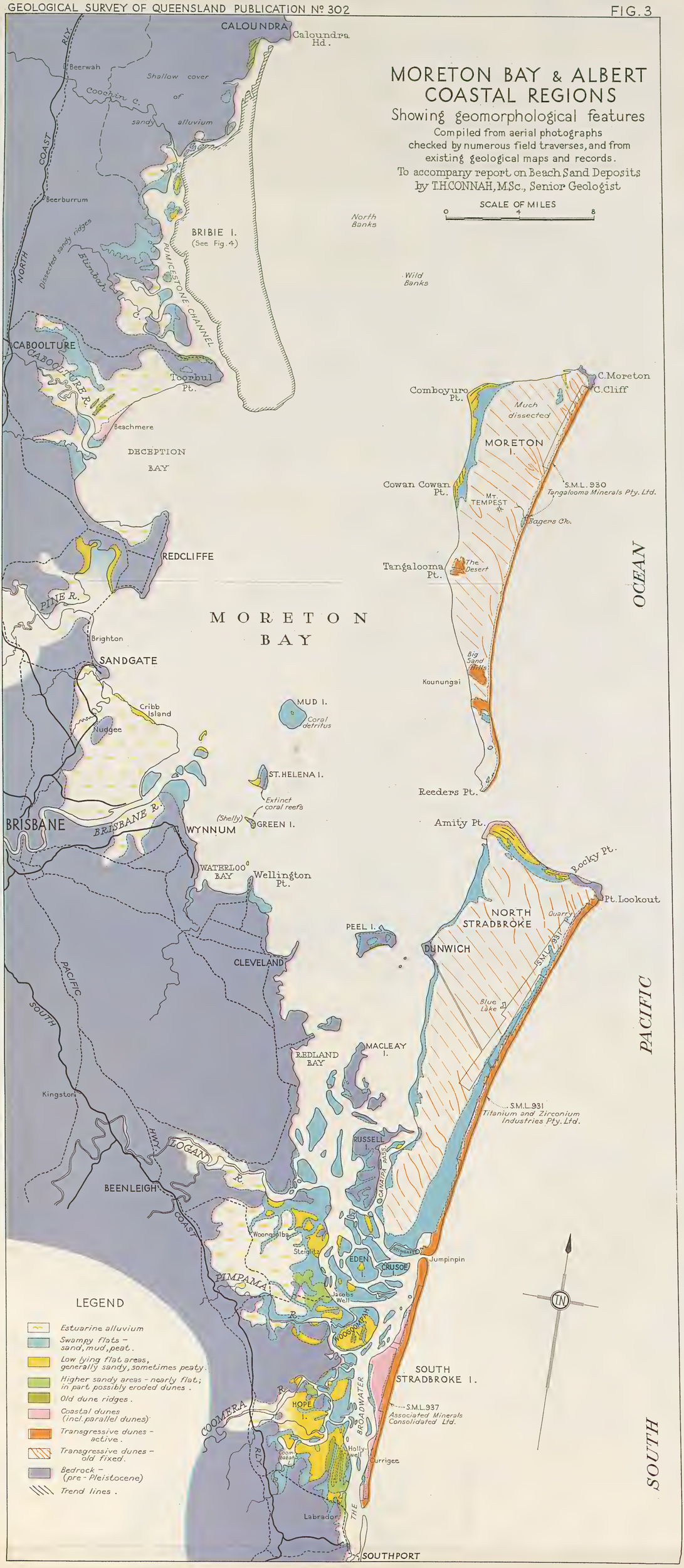
Compiled from aerial photographs checked by numerous field traverses, and from existing geological maps and records.

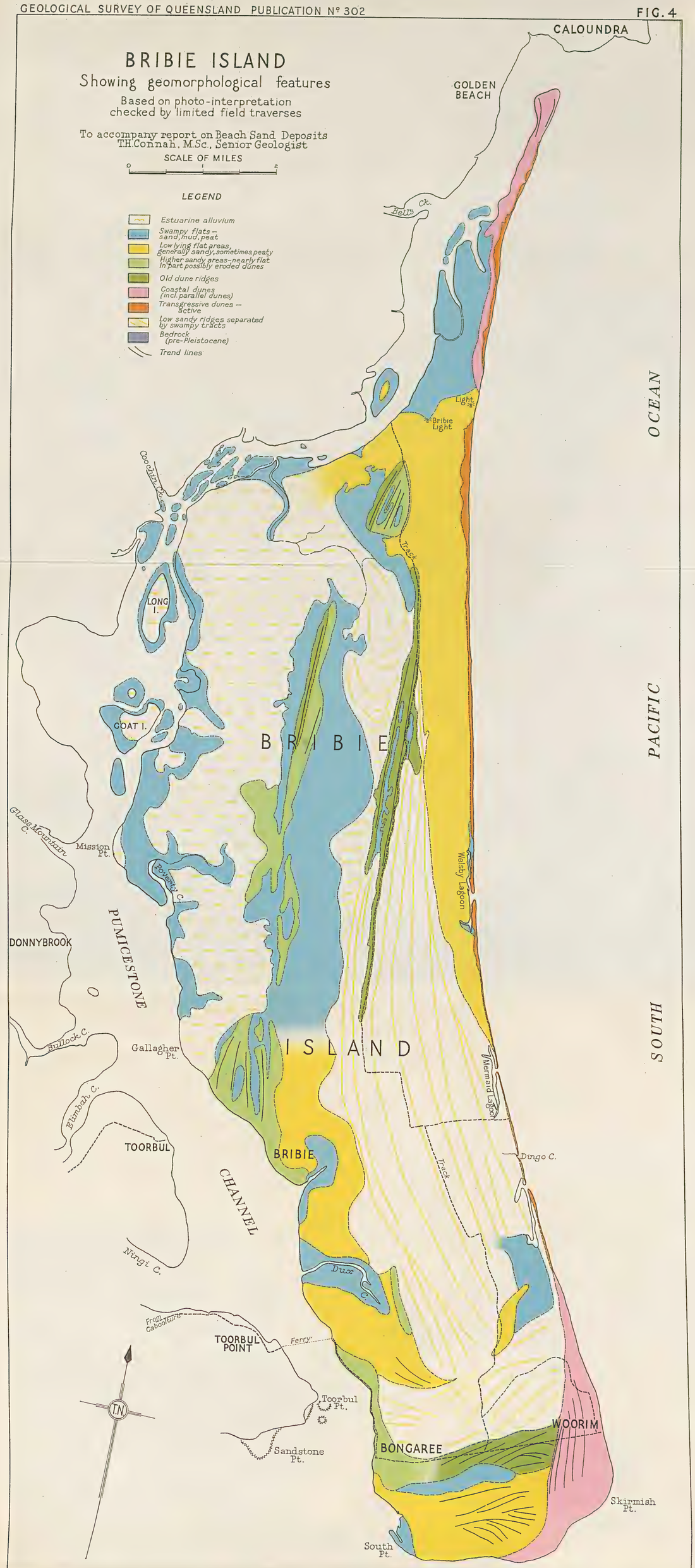
To accompany report on Beach Sand Deposits by T.H. CONNAH, M.Sc., Senior Geologist

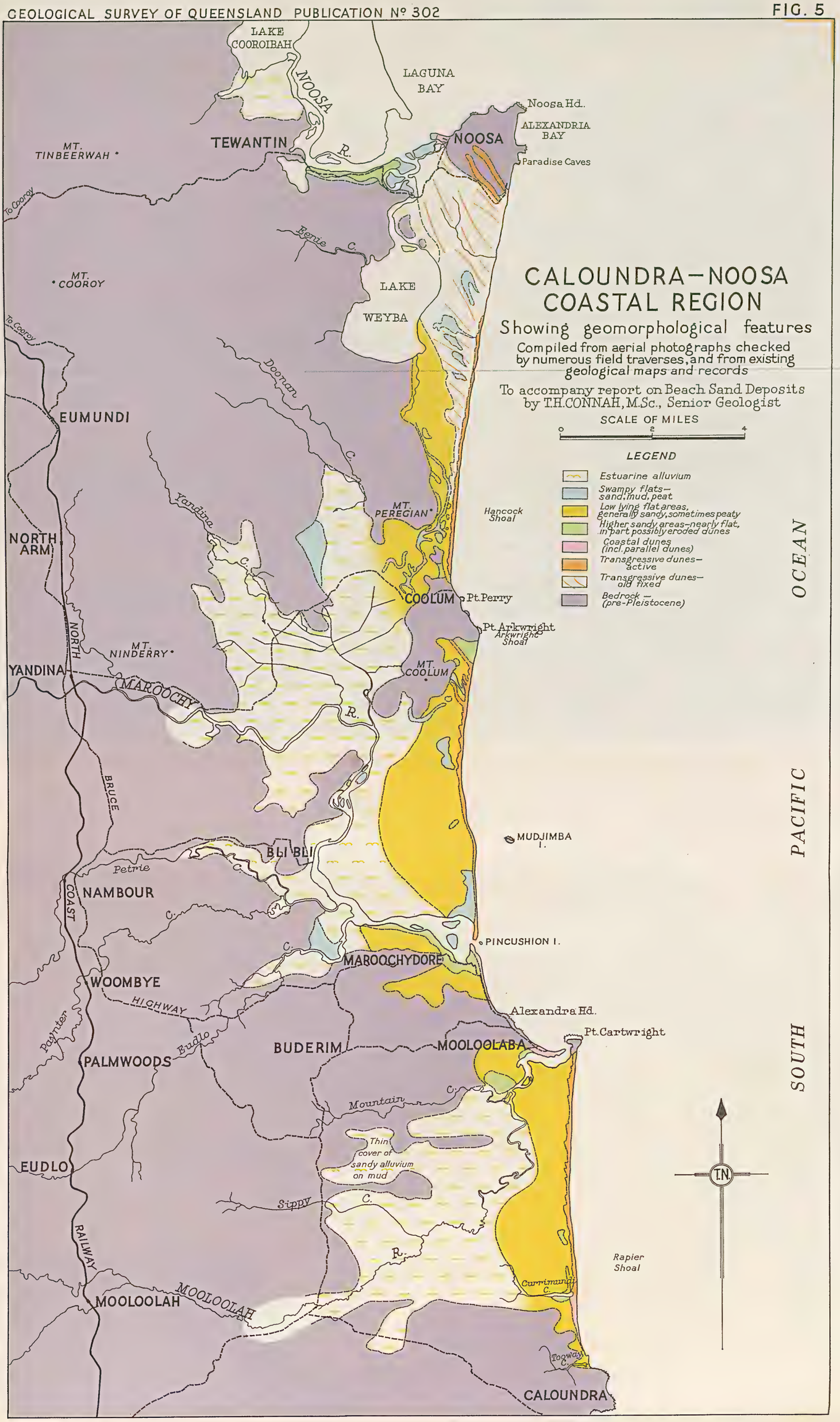
SCALE OF MILES 0 1 2

LEGEND

- Estuarine alluvium.
- Swampy flats – sand, mud, peat.
- Low lying flat areas, generally sandy, sometimes peaty.
- Higher sandy areas – nearly flat; in part possibly eroded dunes.
- Old dune ridges.
- Coastal dunes. (incl. parallel dunes)
- Transgressive dunes – active
- Bedrock – (pre-Pleistocene)


MORETON BAY & ALBERT COASTAL REGIONS
Showing geomorphological features
Compiled from aerial photographs checked by numerous field traverses, and from existing geological maps and records.
To accompany report on Beach Sand Deposits by T.H. CONNAH, M.Sc., Senior Geologist
SCALE OF MILES
0 4 8
CALOUNDRA
Caloundra Hd.
Beerwah
Coochin C.
Shallow cover of sandy alluvium
COAST
RLY.
Beerburrum
NORTH
Dissected sandy ridges
Bli...boo R.
BRIBIE I.
(See Fig. 4)
PUMICESTONE CHANNEL
North Banks
Wild Banks
CABOOLTURE
CABOOLTURE R.
Toorbul Pt.
Beachmere
DECEPTION BAY
REDCLIFFE
PINE R.
MORETON BAY
Brighton
SANDGATE
Cribb Island
Nudgee
MUD I.
Coral detritus
ST. HELENA I.
Extinct coral reefs
(Shelly)
GREEN I.
BRISBANE
BRISBANE R.
WYNNUM
WATERLOO BAY
Wellington Pt.
CLEVELAND
PACIFIC
SOUTH
Kingston
HWY
LOGAN R.
BEENLEIGH
COAST
REDLAND BAY
MACLEAY I.
RUSSELL I.
CANAIPA PASS
Woongoolba
Steiglitz
EDEN I.
CRUSOE I.
PIMPAMA
Jacobs Well
NOGGOMAH
BROADWATER
HOPE I.
COOMERA R.
COOMERA
Holly-well
Coom-babah
Labrador
THE
SOUTHPORT
Currigee
SOUTH STRADBROKE I.
S.M.L. 937
Associated Minerals Consolidated Ltd.
Jumpinpin
SOUTHERN
Comboyuro Pt.
C. Moreton
C. Cliff
Much dissected
MORETON I.
Cowan Cowan Pt.
MT. TEMPEST
S.M.L. 930
Tangalooma Minerals Pty. Ltd.
Eagens Ck.
Tangalooma Pt.
The Desert
Big Sand Hills
Kounungai
Reeders Pt.
OCEAN
Amity Pt.
Rocky Pt.
Pt. Lookout
NORTH STRADBROKE
Quarry
S.M.L. 931
PEEL I.
DUNWICH
Blue Lake
S.M.L. 931
Titanium and Zirconium Industries Pty. Ltd.
PACIFIC
SOUTH
TN
LEGEND
Estuarine alluvium
Swampy flats – sand, mud, peat.
Low lying flat areas, generally sandy, sometimes peaty.
Higher sandy areas – nearly flat; in part possibly eroded dunes.
Old dune ridges.
Coastal dunes (incl. parallel dunes)
Transgressive dunes – active.
Transgressive dunes – old fixed.
Bedrock – (pre-Pleistocene)
Trend lines.


BRIBIE ISLAND
Showing geomorphological features
Based on photo-interpretation checked by limited field traverses
To accompany report on Beach Sand Deposits
T.H. Connah, M.Sc., Senior Geologist
SCALE OF MILES
LEGEND
Estuarine alluvium
Swampy flats — sand, mud, peat
Low lying flat areas, generally sandy, sometimes peaty
Higher sandy areas — nearly flat in part possibly eroded dunes
Old dune ridges
Coastal dunes (incl. parallel dunes)
Transgressive dunes — active
Low sandy ridges separated by swampy tracts
Bedrock (pre-Pleistocene)
Trend lines
CALOUNDRA
GOLDEN BEACH
Bells Ck.
Light
Bribie Light
Coochiemudlo Ch.
Track
LONG I.
COAT I.
BRIBIE
ISLAND
Glass Mountain Ck.
Mission Pt.
Poverty Ck.
DONNYBROOK
PUMICESTONE
Bullock Ck.
Gallagher Pt.
Welsby Lagoon
Mermaid Lagoon
Dingo C.
Track
Yimbah Ck.
TOORBUL
BRIBIE
CHANNEL
Ningi Ck.
Dux Ck.
From Caboolture
TOORBUL POINT
Ferry
Toorbul Pt.
Sandstone Pt.
BONGAREE
WOORIM
Skirmish Pt.
South Pt.
TN
OCEAN
PACIFIC
SOUTH



CALOUNDRA—NOOSA COASTAL REGION

Showing geomorphological features

Compiled from aerial photographs checked by numerous field traverses, and from existing geological maps and records

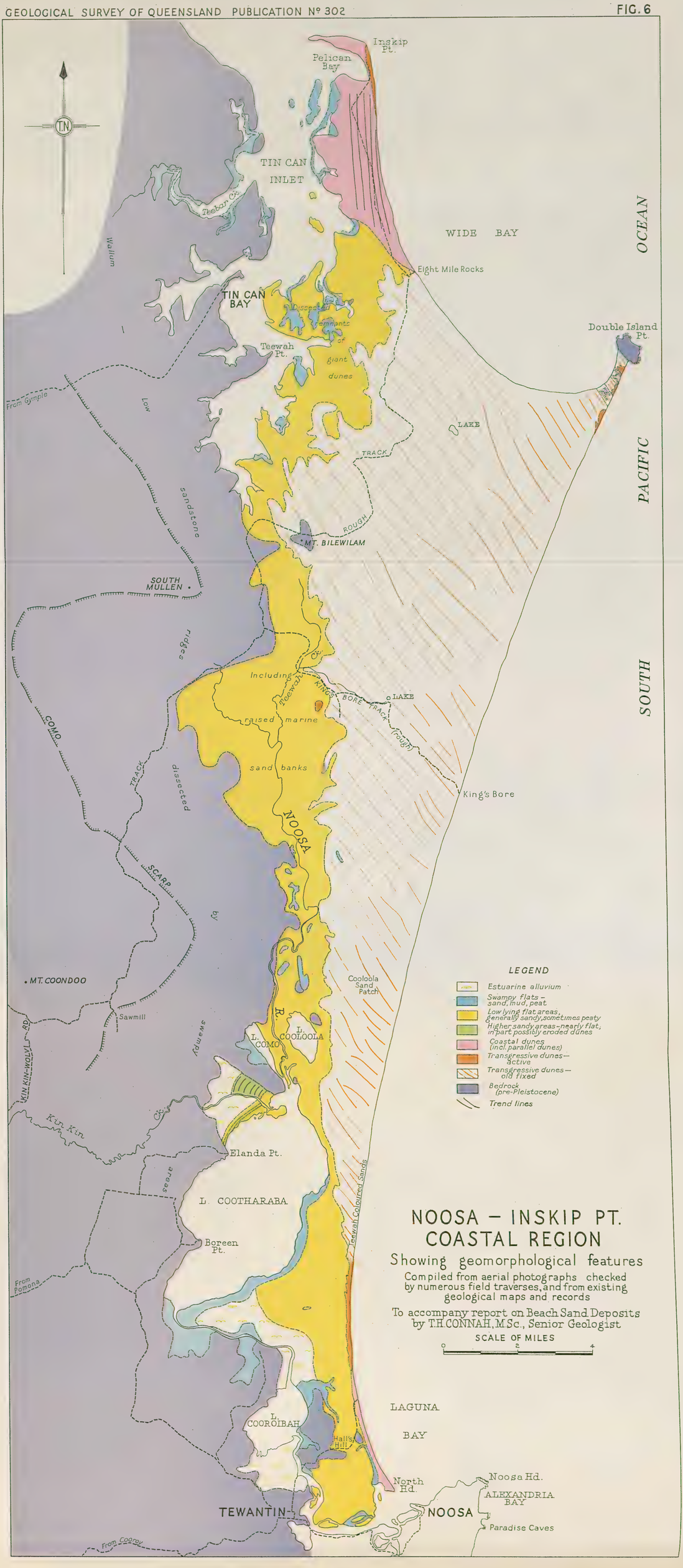
To accompany report on Beach Sand Deposits by T.H. CONNAH, M.Sc., Senior Geologist

SCALE OF MILES

0 2 4

LEGEND

- Estuarine alluvium
- Swampy flats—sand, mud, peat
- Low lying flat areas, generally sandy, sometimes peaty
- Higher sandy areas—nearly flat, in part possibly eroded dunes
- Coastal dunes (incl. parallel dunes)
- Transgressive dunes—active
- Transgressive dunes—old fixed
- Bedrock — (pre-Pleistocene)


Inskip Pt.
Pelican Bay
TIN CAN INLET
Teebar Ck.
Wallum
WIDE BAY
OCEAN
Eight Mile Rocks
TIN CAN BAY
Dissected remnants of giant dunes
Teewah Pt.
Double Island Pt.
From Gympie
Low sandstone ridges
LAKE
TRACK
ROUGH
MT. BILEWILAM
SOUTH MULLEN
PACIFIC
Including Teewah Ck.
KINGS BORE TRACK
LAKE
raised marine sand banks
trough
King's Bore
COMO TRACK
dissected
NOOSA R.
SCARP
MT. COONDOO
Sawmill
Cooloola Sand Patch
L. COMO
L. COOLOOLA
swamps
KIN KIN-WOLVI RD.
Kin Kin Ck.
Elanda Pt.
areas
L. COOTHARABA
Teewah Coloured Sands
Boreen Pt.
From Pomona
SOUTH
LAGUNA BAY
L. COOROIBAH
Hall's Hill
North Hd.
Noosa Hd.
ALEXANDRIA BAY
TEWANTIN
NOOSA
Paradise Caves
From Cooroy
LEGEND
Estuarine alluvium
Swampy flats – sand, mud, peat
Low lying flat areas, generally sandy, sometimes peaty
Higher sandy areas – nearly flat, in part possibly eroded dunes
Coastal dunes (incl. parallel dunes)
Transgressive dunes – active
Transgressive dunes – old fixed
Bedrock (pre-Pleistocene)
Trend lines
NOOSA – INSKIP PT. COASTAL REGION
Showing geomorphological features
Compiled from aerial photographs checked by numerous field traverses, and from existing geological maps and records
To accompany report on Beach Sand Deposits by T.H. CONNAH, M.Sc., Senior Geologist
SCALE OF MILES
0 2 4

FRASER ISLAND

Showing geomorphological features

Based on photo-interpretation
checked by limited field traverses

To accompany report on Beach Sand Deposits
by T.H.CONNAH, M.Sc., Senior Geologist

SCALE OF MILES
0 4 8

LEGEND

- Estuarine alluvium
- Swampy flats – sand, mud, peat.
- Low lying flat areas, generally sandy, sometimes peaty.
- Higher sandy areas - nearly flat; in part possibly eroded dunes.
- Coastal dunes. (incl. parallel dunes)
- Transgressive dunes – active.
- Transgressive dunes – old fixed.
- Bedrock – (pre-Pleistocene)
- Trend lines.

Sandy Cape
Lighthouse
Rooney Pt.
LAKES
PLATYPUS BAY
Waddy Pt.
Middle Rocks
Indian Hd.
Wathumba C.
Bowal C.
HERVEY BAY
Bowarrady C.
Woralie C.
LAKE BOWARRADY
OCEAN
Sandy Pt. (Moon Pt.)
FRASER ISLAND
Eli C.
Maheno Wreck
WOODY I.
URANGAN
Bogimbah
Bogimbah C.
Urang C.
Poyungan C.
Yidney Rocks
STRAIT
PACIFIC
LAGOONS
Second C.
Third C.
Fourth C.
BINGHAM
Poyungan Rocks
MARY R.
SANDY
LAKE McKENZIE
Woongoolbver C.
LAKE WABBY
Fraser Is. School
One Tree Rocks
FURONG RD.
Ungowa
LAKE BIRRABEEN
GREAT
SOUTH
Yankee Jack C.
LAKE BOEMINGEN
Frud C.
Fig Tree C.
SEE INSET
Boonooroo Pt.
"WALLUM"
North Spit
Hook Pt.
Inskip Pt.
North Spit
Hook Pt.
— INSET —
SCALE 2 1 0 2 MILES

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 302A

INDEX (No. 12)

TO

Vol. II of NEW SERIES

Publications Nos. 292 to 302

By J. CLEARY

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